POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

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JULY
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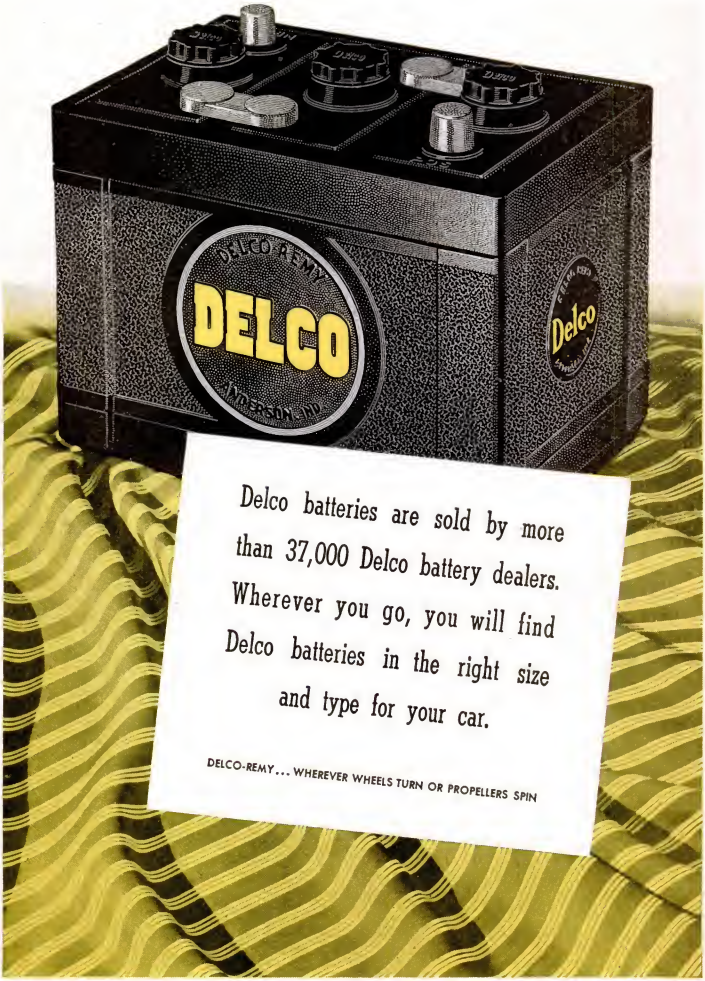
GARDEN IN THE DESERT
PAGE 92



Delco batteries are sold by more than 37,000 Delco battery dealers. Wherever you go, you will find Delco batteries in the right size and type for your car.

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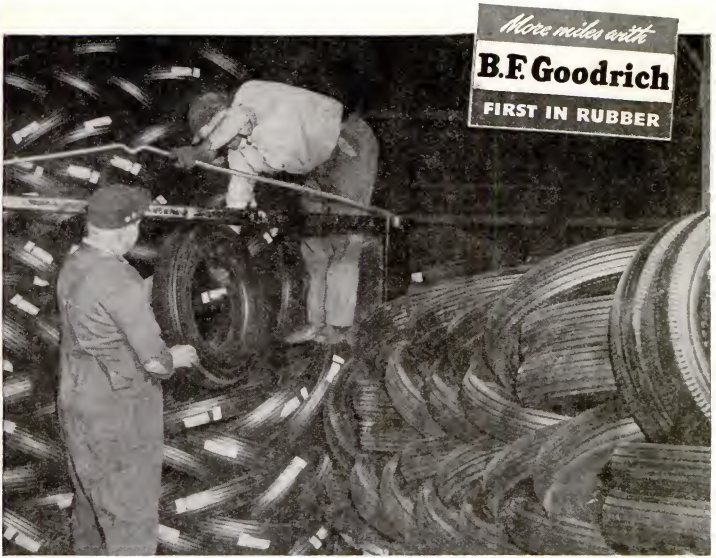


THOUSANDS ON THEIR WAY—THE NEW TIRES THAT OUTWEAR PREWAR TIRES

You can order a set of these tires for your car now

RIGHT NOW the nation's tire dealers are getting more passenger-car tires than ever before in history—75 per cent more for the first six months this year than the first six months of 1940, the last normal prewar year. This is in addition to the thousands of tires being supplied to automobile manufacturers for use on new cars.

But there's more demand for some than others and big extra demand for B. F. Goodrich. Naturally people want the tire that outwears prewar tires. So it's well to order a little in advance.

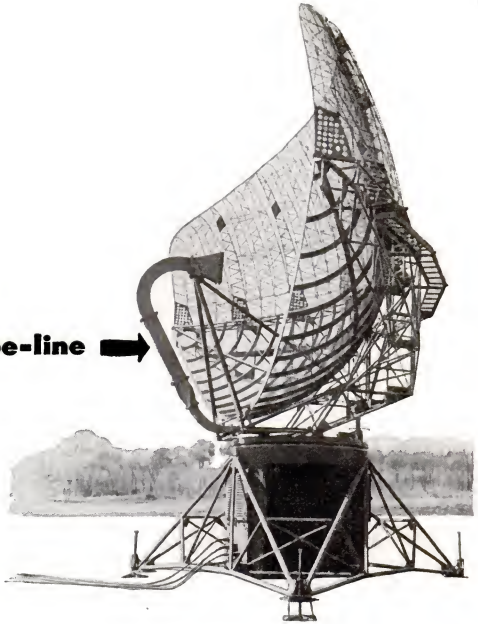
The B. F. Goodrich Silvertown is a better tire—that's why there is a bigger demand for it. It has a new tread design, slightly wider and flatter, that puts more rubber on the road—gives extra miles of service because it wears longer and more evenly. This longer wearing tread is backed up by a strong tire body—better cords and more of them—for resistance to bruising and damage from accident.

If you need new tires, or may need them soon, the thing to do is to check with your dealer now. He may have tires for your car in stock. If not, it will be well worth your while to place your order and wait a little longer to be sure of getting the new B. F. Goodrich Silvertowns that outwear prewar tires. *The B. F. Goodrich Company, Akron, Ohio.*

B.F.Goodrich

FIRST IN RUBBER

electrical pipe-line



Microwaves make their journey from apparatus to antenna not by wire, cable, or coaxial —but by *waveguide*.

Long before the war, Bell Laboratories by theory and experiment had proved that a metal tube could serve as a pipe-line for the transmission of electric waves, even over great distances.

War came, and with it the sudden need for a conveyor of the powerful microwave pulses of radar. The metal waveguide was the answer. Simple, rugged, containing no insulation, it would operate unchanged in heat or cold. In the radar shown above, which kept track of enemy and friendly planes, a waveguide conveyed microwave pulses between reflector and the radar apparatus in the pedestal. Bell Laboratories' engineers freely shared their waveguide discoveries with war industry.

Now, by the use of special shapes and strategic angles, by putting rods across the inside and varying the diameter, waveguides can be made to separate waves of different lengths. They can slow up waves, hurry them along, reflect them, or send them into space and funnel them back. Bell Laboratories are now developing waveguides to conduct microwave energy in new radio relay systems, capable of carrying hundreds of telephone conversations simultaneously with television and music programs.

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

BELL TELEPHONE LABORATORIES

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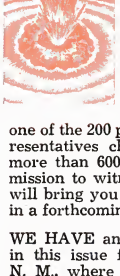

WE ARE sitting at the ringside of the greatest show on earth this month. The scene is Bikini, and our Aviation Editor, Aubrey O. Cookman, is there to watch the atom bomb hit the target fleet. He is one of the 200 press and radio representatives chosen from among more than 6000 who sought permission to witness the event. He will bring you his ringside report in a forthcoming issue.

WE HAVE an eyewitness report in this issue from White Sands, N. M., where Tom Stimson, our Western Editor, saw the V-2 rocket take off for the ionosphere. He also tells of a visit to the place where rockets are born—at California Tech.

OUR waterfront reporter brings the comforting assurance that if you can't get beef, there still is fish. For, he says in an August feature, the fleet has "gone scientific" and scouts for schools of fish with sonar and fathometer.

BIRTH and death department—in one August feature you'll watch the wind-tunnel birth of one of the world's longest suspension bridges. And "They Die a Thousand Deaths" tells an exciting story of Hollywood's stunt men.

THE CRAFTSMAN section will give one easy lesson in building three versatile spot-welders that operate on 110 or 220-volt current. The largest size handles 3/16-inch stock, the smallest, sheet metal. Then there's an article on how to construct a fireplace for cold winter months that heats the air, then circulates it through the room.

LOST treasure, or even pipes in a wall, can be located with a homemade metal detector described in the August Radio section.

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The central magazine houses a strip abrasive cartridge, to be fed out as needed in front of the eight brushes which "cushion" the abrasive, and force it evenly over the most difficult surfaces. The Sand-O-Flex comes in 3 sizes, and is adaptable to any stationary or portable motor shaft, with speeds up to 1750 RPM. Abrasives are available in grits for every need.

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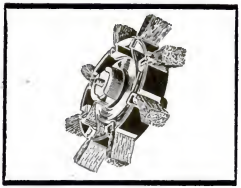
You can get complete information from the Sand-O-Flex Corporation 4373 Melrose Ave., Los Angeles 27, California



Abrasive Cartridge Shown Open

AA-77

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suppose that a better job had opened up in your company—carrying with it promotion and more money—could you qualify?

If you were boss, would you select "YOU" for that better job?

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Jerry, the talking dog, is entertaining hospitalized veterans, by courtesy of the Pyroil Company. Picture of Jerry, sent on request.

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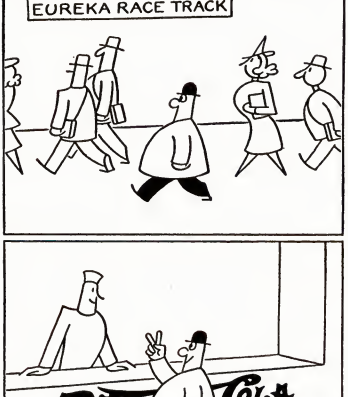

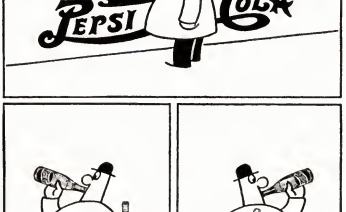

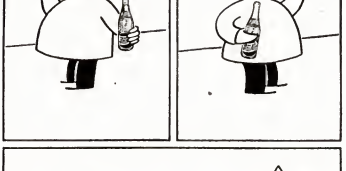

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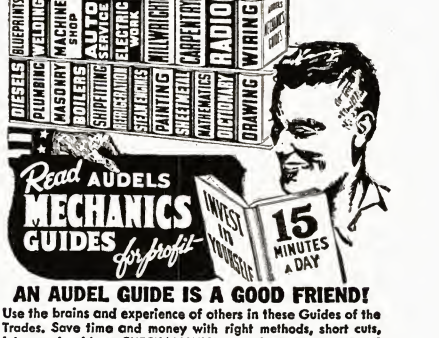

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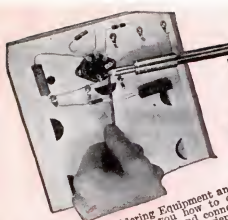

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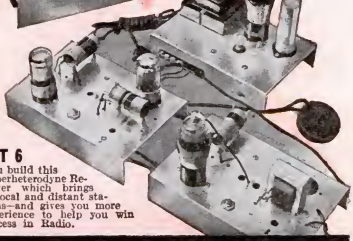

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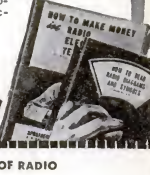

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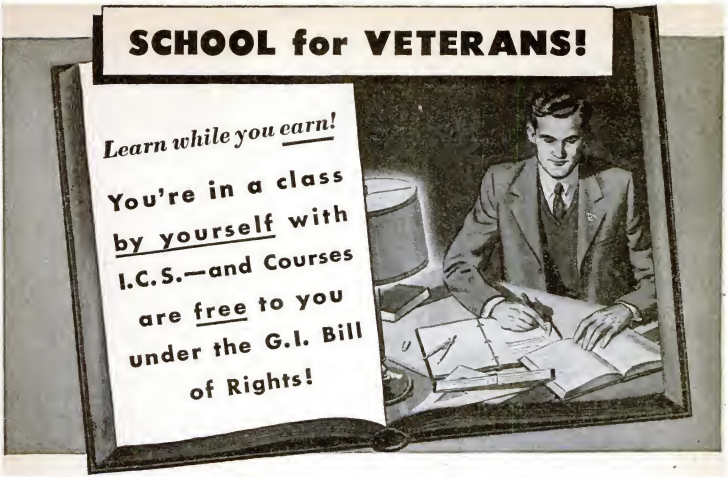

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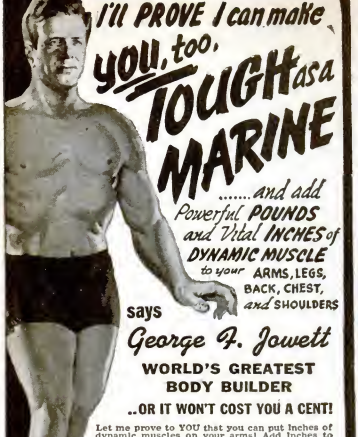

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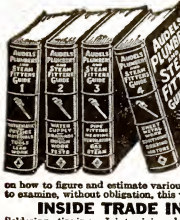

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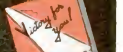

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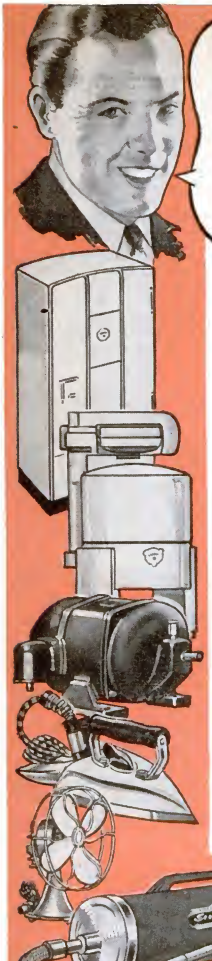

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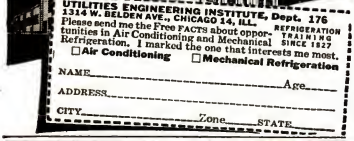

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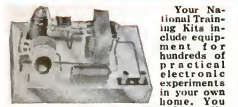

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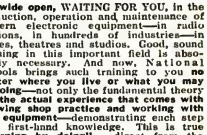

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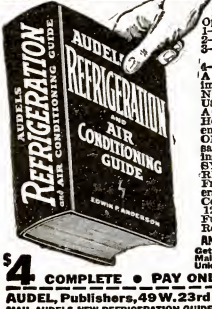

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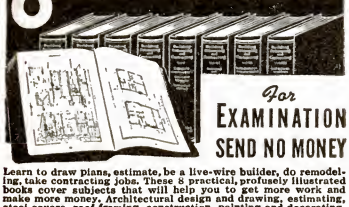

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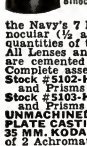

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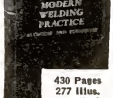

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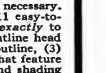

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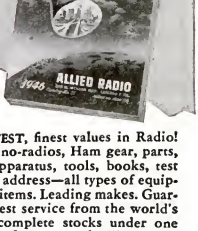

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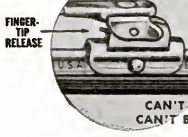

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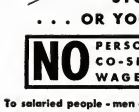

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BUILD Your own trailer! Save money! Have every feature you want! Plans for house, sport, camp and utility trailers. Catalog describing 9 models 10c. 15c in Canada and overseas. Jim Dandy, Box 125-A, Wausau, Wisconsin.

MOTORCYCLES, BICYCLES, MOTOR-SCOOTERS AND SUPPLIES

MOTORSCOOTER $10, motor $3, tires $2! Send 25c for big new catalog Number 916, just printed, listing scores of other sensational bargains in motors, wheels, motorscooters, motorbikes, servicycles, tires, etc. Associated, Box CS-1764, Toledo, Ohio.

GENUINE Moto-Scoot parts. Amsco centrifugal clutch. Windshields, sidecars. All other parts and accessories. Write for parts list. Also genuine engine parts for Briggs and Stratton, Lauson. American Moto-Scoot Co., 1313-23 Carroll Ave., Chicago 7, Ill.

MOTORBIKE Manual containing motorbike and scooter plans and motor tune-up information, $1.00. Veco, P.O. Box 124, Evansville, Ind.

GOVERNMENT Surplus Harley 45″ motors brand new $75 and up. New bicycle motors $75. Gerald Baughman, Wadsworth, Ohio.

HARLEY-DAVIDSON Service, parts, accessories. Send $2.25 for Army Motorcycle Manual, 10c for bulletins. Knuth's (Harley-Davidson Factory Dealer), 2491 FondduLac, Milwaukee, Wis.

RETREADING—Only mid-west plant equipped to tread motorcycle tires (all sizes) in famous Zook Armor Tread. All non-skid design. Substantial dealer discount. Send tires direct to Zook Tire Company, Denver, Colorado.

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FACTORY Built midget car $65; Johnson motorbike $45; Servicycle $75; 3-wheel Cushman motorscooter $65; homemade motorscooters $15 up, complete; motors $8 up. Tires for motorscooters and midget cars $1.50 up. Mailorder only. Send 25c for new Directory Number 14 just out listing these and hundreds of other bargains in motorcycles, outboard motors, motorscooters, midget racers, parts, plans, etc. (35c by first class mail.) Midget Motors Directory, Athens, Ohio.

BICYCLES Schwinn and Monark. Just received from factory. Send dime for list. Century Cycle Company, 3447 Lawrence Avenue, Chicago 25, Illinois.

TIRES, Inner tubes, wheels, for small trucks, wheelbarrows, midget cars, power scooters, farm equipment, carts, etc. Sizes 8″ to 18″ o.d. in 2, 4, and 6 ply first-line quality tires, with removable inner tubes and heavy duty demountable wheels. Also caster forks, straight or swivel types. Free circular and prices. Experienced tire engineers to advise on your special equipment problems. Jahant Co., 626 East Exchange Street, Akron 6, Ohio.

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BICYCLE Book, how to buy, rebuild, sell used bicycles 50c. John Collett, Handley, Texas.

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FLYING Flea, plans $1.00. Lightplane manual $1.00. Illustrated circulars 20c. Craftsmann Books, Box 1153-P1, Milwaukee 1, Wis.

JET Propulsion circular sent builders bikes, airplanes. Byrum, Buffalo, Okla.

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EDISON Batteries. Light. Power. Fifteen year life. Unconditionally guaranteed. Complete lighting plants. Free literature. See-Jay Company, 321 Yonkers Avenue, Yonkers, New York.

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WE Do nickel and chromium plating. Globe Company, Fitzgerald, Georgia.

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"BUILD Your Own Arcwelder." Inquiries welcome. Welders Club, AB-3432, Chicago 54.

THUNDERBOLT—Transformer welder, dial-control, 3 heat stages, 60 amps, 110 volts-a.c., takes up to 3/32 rod, carrying case, all accessories, illustrated instructions. Professional heavy duty welding, brazing outfit. $39.50. Also "Super-Welder," for light work, 110 volts, a.c.-d.c. $19.95. Save 2%, send check. Or order C.O.D. west of Mississippi. $5.00 deposit required on Super-Welder, $10.00 on Thunderbolt. Super-Welder Mfg. Co., Dept. PMC, 23 E. 20th St., New York 3, New York.

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SURFACE Plate 8"x14"x2¼" high, 20 ribs, wood handles included. Unfinished $4.50, machine finished $9.50, 25 lbs. Angle plate 4"x3"x3" ribbed, unfinished, 75c, machine finished $2.00, 3 lbs. (Castings normalized.) Model Tool Service, Rock Falls, Ill.

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DRILL Grinder for twist drills $2.95, and other craftsman's tools. See ad on page 251.

INDEX Heads for sale. Very inexpensive. Sixty-two different divisions. Used on small lathes, drill press, milling machines, etc. Make gears, hobbs, cutters, etc. Very accurate, and durable. Not a toy. Used by defense schools and hobbyists. Write for free folder. Long's Index Heads, 2117 East B St., Torrington, Wyo.

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USED Outboard motor parts. Outboard Exchange, 1194 Remsen Ave., Brooklyn, 12, N. Y.

FORD-Mercury-Zephyr marine conversions. Catalog 10c. Lehman Manufacturing Company, Dept. D. Newark 2, N. J.

BOAT Designers are highly paid professionals. Complete course by mail. Catalog. Westlawn. Montville. N. J.

NINE Plywood boat plans 50c. Catalog boat building plans 10c. The Rudder, 15 Murray Street, New York.

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USED Marine motors, propellers, marine fittings, conversion manifolds. Stokes Marine Supply, Coldwater, Michigan.

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PRACTICAL Winding of a.c. motors. A course of instruction on winding, connecting, and testing single, two, and three phase motors. Clearly written in everyday non-technical language. Illustrated throughout. This book is recommended for beginners interested in learning motor rewinding and repair. Satisfaction guaranteed or remittance refunded. $2.00 prepaid. Educational Advancement Co., Dept. Y, Lakewood, New York.

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LIVELY Fishing worms. 200—$1.00, 100—$1.00. Harry Dean, Milford, Mich.

THE Tent-house solves housing and vacation problems. Sleeps eight. Radical features. Tested six years. Plans $2.00. Box 293, Jamaica, N. Y.

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ST. LUCIA, Ceylon, South Seas, Levant, Caucasus, all 3c with approvals. Hall, 610 Brackenridge, Corpus Christi, Texas.

25 JAPANESE Stamps 5c with approvals. Frank, 177 Elmcraft, Rochester 9, N. Y.

60,000 VARIETIES Low priced approvals. Discounts. Scott, 30 Baker Ave., Lexington, Mass. 6.

3,000: 50 COUNTRIES $2: Approvals: Griest, 409 Oak, Davenport, Iowa.

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MINT George VI eight crown colony pictorials including bi-colors 10c to serious approval applicants. Mutual Stamp Service, 5145P Village Green, Los Angeles 16, California.

BIG Premium, packet free to approval applicants. 3c postage. Oedamer's, 1738 Arlington, Corpus Christi, Texas.

75 U. S. Airmails, commemoratives 25c. Corryville Exchange, 119 St. Clair, Cincinnati, Ohio.

HOT Dogs! 21 different super stamps 10c with approvals. Carlson, 312½ Riverdale, Glendale 4, Calif.

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NETHERLANDS Admirals complete. 17 mint beauties $1.40. List. Vic and Ethan's Stamp Company, R.F.D. 6, Jackson, Mich.

5 BEAUTIFUL Sets 10c with personalized approval selections. Hintz, R-1, West De-Pere, Wis.

400 BRITISH Empire mixture 25c. U. S. foreign approvals. Box 448, Anoka, Minn.

APPROVALS. Scarce foreigns 5c—$2.50 each. Bargains. References. Coelho, Spivak, Colorado.

ELEVEN Beautiful Maoriland peace mint set, $1.00. Ditto first-day official covers $2.00. Nine, Cook Islands, Samoa, F/D covers, superbly cancelled, $2.00. Singles, 80c. Scarce! Charity healths. "Princesses" 1944 mint set, 30c. 1945 "Peter Pan" 25c. Mint. Page, Tokomaru Bay, E. C., New Zealand.

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RUSSIAN "Grinning Bear" stamps for conquered Berlin. 4 different 5c. Approvals. Fields, Box 36, Brookhill 22, Va.

U. S. Price list. Send postage. State Stamp Service, 1225 Park Building, Pittsburgh 22, Penna.

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125 DIFFERENT U. S. Stamps, 30c. Frank Stroskey, Box 55, Perth Amboy, New Jersey.

U. S. Price list. Send postage. Stanley Gibbons, 38-P Park Row, New York.

APPROVAL Sheets, Frederick B. Driver, 909 Finance Building, Philadelphia 2, Pa.

PENNY Approvals, that satisfy. Neil Gronberg, Box 5441-P, Philadelphia 43, Penna.

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UNITED Nations, scarce 5c U. S. commemorative and packet 30 different U. S., including airmail, commemoratives, revenues, etc. Catalogs 65c—to approval applicants for 5c. Curhan Stamp Company, Dept. H, Gloucester, Mass.

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FREE U. S. price list. Postage 3c. Mark Hanna, 335 - 5th Avenue, Pittsburgh 22, Penna.

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"GEM Cutting" profitable, interesting hobby. Instructive illustrated booklet, one dollar. Mineral Specimens Company, Box 1191, Santa Monica, Calif.

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INVENTING Can be an interesting and profitable hobby. Write for complete particulars. Institute of American Inventors, Dept. 40-E, 1926-Eye St. N. W., Washington 6, D. C.

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COLLECT Colorful Army patches. Pictures, prices and sample patch only 10c. Insignia Mart, 703 Broadway, N. Y.

UNUSED Match book covers. 100 all different $1.00. 35 Royal Flash covers $1.00. Free list. Charles Edelman, 1311O East 84, Cleveland 3, Ohio.

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SWORDS, Rapiers, daggers, pistols, armor. Illustrated catalog 50c. Robert Abels, 860-A Lexington Ave., New York.

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MUSEUM Specimens. Indian relics, curios, den decorations. Illustrated catalogue, identification chart 25c. We also buy. Museum Supplies, 6601 Oshkosh, Chicago 31, Illinois.

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AGATES From atom bomb city $1.35 pound. Vik, Box 724, Richland, Wash.

GEM Cutters, jade, $1.00 oz. 2 moss agate 25c. Algae chalcedony agate turritella jasper $1.00 lb. Gem House, Casper, Wyoming.

CUTTERS, Collectors, mixed, pound, Agates, Jasper, wood $1.00. Smith, Box 422F, Albany, Oregon.

12 ROUGH Red garnets 36 gram for only $2.40. Brilliant cut genuine Australia green garnet $3.00. Finest cut optical prism 1¾ inch $3.00. Federal tax included. Ernest Meier, Church St. Annex, Post Office Box 302, New York 8, N. Y.

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TALKIES! Convert your silent 16mm. projector into sound with our guaranteed parts kit. Plays all 16mm. sound films. Quickly assembled at home. Special introductory offer: send this ad now with $19.95, check or money order, and we will include sound test film, instruction manual and full information on how to use with your radio, postpaid. Soundtech, Box 3071, Hollywood 28, Calif.

CAMERAS! Hundreds! From private owners. Free details: Seymour, 101-M Sherman, New York 34.

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PHOTO Printer kit $1.00. L. Spada, 10 Lexington, Wethersfield 9, Conn.

GET Clean scratchless negatives. Ultrafine stainless steel filter stops developer sludge, lint, tapwater, grit. Fast and effective. $1.75 postpaid. Larsen-Bowen, Box 107, Villa Park, Ill.

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PHOTO Finishers. $15 per thousand cash paid for empty spools 127, 120, 620, 116 and 616. Write stating quantities available. Howard West, 3 W. 42nd St., New York 18, N. Y.

FILMS, Fresh, dated 1948, outdoor type. 127—$4.09 dozen. 120 or 620—$4.81 dozen, 116 or 616—$5.41 dozen, postpaid. "Cameraman." 542-5th Ave., New York 19.

ENLARGERS—Build your own. Kit of parts, $6.00. Free particulars. Krescent Engineering, Box 586, North Hollywood, Calif.

BASS Says: Trade cameras? For 36 years Bass has satisfied thousands everywhere! Finest equipment available. Always satisfaction guaranteed or your money back! Bass buys 'em, sells 'em, trades 'em. Bass Camera Company, Dept. AG, 179 W. Madison St., Chicago 2.

CASH! Spot cash for cameras, lenses, binoculars, movie and still equipment. Send full description for prompt cash offer. Over 36 years of dependability. Bass Camera Company, Dept. AG, 179 W. Madison St., Chicago 2.

CAMERAS, Enlargers, projectors. Free catalog. Cavalier Camera, 1822 Center, Pittsburgh (19), Penna.

PHOTOGRAPHY For pleasure or profit. Learn at home. Practical basic training. Long established school. Write for booklet. American School of Photography, 1315 Michigan, Dept. 3432, Chicago 5.

USED Camera Directory, Box 1031-M, Canton, Ohio—lists hundreds of war-bargain used cameras—35mm., Speed Graphics, Kodaks, Rolleiflex—many others. Send 25c for latest issue.

HAVE You a camera? Improve your hobby of photography and learn how to make better pictures. Write today for our latest book catalog and sample copy of American Photography, containing articles and pictures by the world's foremost writers and photographers. Camera House, 601, 353 Newbury St., Boston 15, Mass.

DARKROOM Supplies. Federal enlarger $35.30. Papers, chemicals, tanks, printers, dryers, washers, etc. Free price list, bulletin, listing scarce items. Photo-Craft, Box 470-Q, Jamaica 1, New York.

ARGUS 35 MM. R.F. And flash model C3 new $65.98. Malena Co., 616 Market St., Phila. 6, Penna.

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SMITH For quality! Any 8 exposure roll developed, 8 prints and two enlargements, 25c, 8 double-size prints, 25c. 35mm. fine grain developed, 36—3¼x4½ enlargements, 90c; 18—55c. Cartridge refilled, 36 exposures, 35c; 18—20c. Write for sample print, mailers and price list. Smith Studios, 8 Saint John Street, Plains, Penna.

GENUINE Moen-Tone finishing approved by thousands since 1898. 8 exposure roll developed with 16 prints or 8 enlargements—25c. Moen Photo Service, 452 La Crosse, Wisconsin.

8 HOUR Service. Your 8 exposure roll developed and printed jumbo or regular size 25c, deckled edge if requested. 12 exposure rolls 35c, 16 exposures 50c, 36 exposures $1.00. Reprints jumbo or regular size 3c each. All film developed fine grain. Workmanship, materials and 8 hour service guaranteed throughout. Quality Photo Service, Box 468, San Francisco 1, Calif.

NEW Amazing Plastik-Prints. Secret process. Post war invention. Nothing like it. Sharper, clearer, fade-proof, water resistant prints. Lifetime guarantee. 6 or 8 exposure roll finished 30c. Reprints 3c. World Photo, Joplin 9, Mo.

INDIVIDUAL Attention each negative guarantees outstanding pictures. Roll developed and 8 prints—25c. 8 beautiful 6x4 enlargements—35c. Fresh film. Write for free mailers and other offers. 24-hour service. Universal Photo Service, Box 612-O, La Crosse, Wisconsin.

ROLL Developed, 8 prints, 25c. Free enlargement coupon. Free mailer on request. Smith's Foto, 9621 Dobson, Chicago 28, Ill.

CENTURY Delivers work and service that can't be beat. 8 exp. roll 25c with two professional enlargements free. Century Photo Service, LaCrosse, Wisconsin.

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ROLL Or negatives developed, 16 pictures 25c. Dependable Photos, 2960 Gresham, Chicago 18, Illinois.

COLOR Prints from any transparency. Write for additional information. Ross Color Lab., 46 Westmore Rd., Mattapan, Mass.

FREE—Set of filters. Send names and addresses of four camera owners. Photo-Craft, Canton 1, Ohio.

VETERANS' Special offer—5% discount on orders over $5.00. For yourself and members of your family desiring expert developing and printing of 35mm. film. Color film—35mm.—your color transparencies made on prints with exclusive white borders. Size 2¼"x3¼", only $1.00; size 3¼"x4½", only $1.25; size 5"x7", only $2.50; size 8"x10", only $3.75. These color prints are beautiful—Black and white film—35mm. Free cartridge refill with each order. Your films developed (fine grain processed) and enlarged to beautiful prints Size 3¼"x4½", 36 exposure roll developed and enlarged $1.75, 18 exposures $1.25. Prompt service. Postpaid. Your order given careful attention by expert photographic technicians. Send postal money order with films by air mail. Harton's, Mainland Station, Box 1291, Daytona Beach, Florida.

PHOTOGRAPHS Expertly oil colored, 50c. Barton, Sta.-B. 6205, Miami, Fla.

MONEY Back guarantee—All this for 25c: Roll developed, 8 bigger deluxe prints, also 8 regular prints, plus two beautiful enlargements and tasteful Leathertone frame. Lifetone Photo Company, Dept. 739, Des Moines, Iowa.

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ROLL Developed and 8 beautiful enlargements 2 to 6 times larger. Deckled edge—high gloss. Any 8 exposure roll 25c coin. 12 ex. 35c—16 ex. 50c—36 ex. $1.00. Reprint enlargements 3c each. Alden Photos, 94-3 Astor Sta., Boston, Mass.

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FILM 6 Or 8 exposure roll developed & printed plus 5x7 enlargement free—complete 25c. Mail film to Joy-Photos, G.P.O. Box 606, New York 1, N. Y.

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FAST Delivery. Satisfaction guaranteed. Eight exposure rolls with two prints of each exposure, 30c; or eight jumbo size prints, 35c, completely finished. Write for special reprint prices. Pioneer Photo Print Service, Box 123, Wichita, Kansas.

AT Last we have films: 116 and 616, 38c ea.; 120 and 620, 33c ea.; 127, 27c ea. Roll developed, all your snapshots hand-colored as beautiful as most actual colored photography 35c. Hand colored reprints 4c each, 12 for 45c. Midwest Photo, Janesville 26, Wisconsin.

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FILM Developed, 8 album size enlargements or 16 sparkling prints, 25c; 8 snappy 4x6 enlargements, 30c. Reprints each: contact prints, 2c; album enlargements, 3c; 4x6 enlargements 4c. Crystal Studios, 159-F, Rushford, Minn.

BIGGEST $1.00 Value in 35mm. finishing today. 36 exposure fine grain 3¼x4½ enlargements; deckled, embossed margin and date. Eighteen exposures 75c; 16 exposure splits 55c; 36 exposure reloads 50c. Special: return this ad with $2.00 and we will send five 36 exposure reloads. Free mailers. 8 exposure rolls in beautiful, deckled contact finish with embossed wide margin, 25c. Mailbag Film Service, Box 5440A, Chicago 80, Ill.

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50 REPRINTS $1.00. No limit. Studio, 1408-M Bond, Rockford, Ill.

GLOSS Finish enlargements. 4 5x7 from negative 50c. 3 5x7 from photo 50c. Robert Renshaw, Jr., P.O. Box 478, Chester, Penna.

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EVERY Picture an enlargement! 8 sparkling deckle-edge enlargements and roll developed 25c coin; 116 size or smaller; enlarge reprints 3c. Enlarge Photo, Box 791D, Boston, Mass.

BEAUTIFUL Double-size pictures 3½c each, from 116 and 120 negatives, 3¼x4½ from all other sizes. All work guaranteed. Overnight service. Roll developed and 8 pictures 30c. Roll 12 pictures 45c. Roll 16 pictures 60c. Enlargements on double weight portrait paper 5x7—30c, 8x10—50c. Copies made from any picture 75c. Pacific Photo Service, Box 666, San Francisco, Calif.

SENSATIONAL Introductory offer! Send snapshot or negative, this ad, and 3c. We'll send you a beautiful 7"x5" enlargement! Or, Kodak roll developed with 16 guaranteed deckled-edge velox fade-proof prints or 8 double-size prints, 25c! Special! From your negatives, 16 regular-size or 8 double-size reprints, 25c! Candid rolls—36 exp. 35mm. developed, vaporated, enlarged to 3x4, $1.00! 18 exp. 50c. Reprints, 3x4, 3c each. We have new, perfect 35mm. film. Low prices. Free mailers, details on request. American Studios, Dept. 279, LaCrosse, Wis.

8 PRINTS, All enlarged to nearly post-card size, from your roll or negative, 25c. Willard Studios, Box 3535A, Cleveland 18, Ohio.

DELUXE Photo finishing. Rolls developed and printed. 8 exposures 25c. 12—35c. 16—50c. Enlargements 5"x7", 25c. 8"x10"—40c each. Kensey. B25, 211 W. 145th, New York 30.

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8MM.-16MM. Silent-sound—Black and white and colored film, sold, rented and exchanged. Most reasonable rates in the East. Free catalog. Home Movie Service, 1423 N. 15th St., Phila. 21, Penna.

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"SURPRISE" Assortment 8-mm. colorful titles $1. Guaranteed. LeMoine Films, Nevada, Missouri.

COMPLETE Stocks always of Castle, Official, Pictorial films, 8mm., 16mm., sound. Musicals, soundies, free catalogs. We exchange your films and equipment, or buy them for cash. Frank Lane, 5 Little Bldg., Boston, Mass.

FRESH Movie films 100' 16mm. $2.25, Three rolls $6.00. 25' double 8mm. $1.25, developing included. Ambassador, 479-A Quincy Street, Brooklyn, N. Y.

16MM. MOTOR Driven projector $16.00 postpaid. Selco Products, Danvers 1, Mass.

35MM. SOUND Film—bought, sold, lists Edward Elwell, Brockport, N. Y.

KODACHROME Movies. 8mm., 16mm. Projection length sample "Waikiki Hula," $1.00. Catalog, 25c. World in Color, Box 392-F. Elmira, N. Y.

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LATEST Movies, 8-16 mm., S.O.F. save! 1946 projectors, cameras! Free details! Charlie Poorman, Dept. PM1, Schuylkill Haven, Penna.

GUARANTEED Fresh movie film! Dalite loading! Six spools single 8mm. for Univex cameras, $3.50! Three spools double 8mm., $3.45! Processing free! (Give camera make.) Catalog. C.O.D.'s shipped. ESO-S, 828 West 39th, Kansas City 2, Missouri.

HOME Movies. All kinds. Catalogs, 10c. Box 337-A, Valley Stream, N. Y.

16MM. SOUND Films. Complete subjects, good condition, $1.95 per 400' reel, up. Write for list of over 200 available titles. Blackhawk Films, Dept. PM26, Davenport, Iowa.

FILM, Free processing 100 ft. 16mm. Weston 6, $2.50; Weston 24, $4.90; Weston 64, $4.95; 25 ft. double 8, Weston 6, $1.35; Weston 24, $1.89; Weston 64, $1.99. Free circulars. Fromader Genera, Davenport 7, Iowa.

FRESH Movie camera films 100'—16mm. $2.25, three rolls $6.00, 25' double 8mm. $1.25 developing included. Ambassador, 479-A Quincy Street, Brooklyn, N. Y.

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HOME Mail order business opportunities for you. Big profits, small capital starts you. Particulars free. National, Route 4, Box 1508G, Tampa, Fla.

1946 GIGANTIC Directory of opportunities, advertisers supplies, sources, trade information, mail order ideas, products, wholesalers, valuable tips—just published! Descriptive literature free. Wilkin & Co., 118-AP East Main St., Hillsboro, Ohio.

QUICK Money! "Repairing car batteries." At home! Easy too! Write, Batteryman, Grand Junction, Colorado.

315 GOLDEN Money-making opportunities now ready for you, selling by mail! Details free! Mailway Agency, 10-620P, William, Winnipeg, Manitoba, Canada.

SMALL Capital starts your own advertising agency, at home in spare time. Complete operation exposed. No stock or equipment. Opportunity for large earnings. Stamp brings folder and proof. P. Snyder, Box 4907-A, Philadelphia 19, Penna.

SYNTHETIC Latex with Neoprene base for making flexible molds! Quick drying! Quart $2.00. Gallon $5.95. Full instructions. Plastercraft, 1406 East 43rd Street, Cleveland 3, Ohio.

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WE Start you in business, at home, sparetime, earning $10-$30 weekly selling by mail. Stamp appreciated but not necessary. Driscoll Sales Service, Box 2771-A, Denver, Colo.

COLORGLAZED Concrete pottery made without molds. New, low cost, patented method. Cemetery products, novelties, tiles, floors, etc. Basement leaksealing. Other moneymaking projects. Booklet, details free. Men only. National Potteries Company, Fergus Falls, Minnesota.

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CONCRETE Brick are a profitable product with a well established consumer demand. This is your opportunity to enter the concrete products field with the minimum equipment expenditure. R. S. Reed Company, Three Rivers, Mich.

ELITE Collection contains 137 practical money-making plans; local and mail order. New edition. Particulars free. Elite Co., 220-A Grand St., New York 13.

137 WAYS To make money, in home or office, business of your own. Full particulars free. Elite Co., 220-A Grand St., New York 13.

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PLASTICS. Your own business at home. Make your own plastics, no expensive equipment needed, formula and molding instructions $1.00. Box 224, Wickliffe 17, Ohio.

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BUILD Miracle homes. Yours. Others. Chamberlain, Fitzsimons Building, Pittsburgh 22, Penna.

LATEX For making flexible rubber moulds. Thoroughly tested. No shrinkage. Complete instructions with each order. Stoneham Rubber Co., Box 244, Stoneham 80, Mass.

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AGENTS—To mail our literature. Good profits. Home business. Maywood, 1133 Broadway, New York.

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200 MONEY Making deals. Plans. Rare formulas. Schemes. Folio free. Formico Eng., Box 572, Dayton, Ohio.

50 MAIL Order opportunities. Booklet 25c. Modern Mails, 102 West 15th, Bloomington, Indiana.

"HOW To Sell by Mail." 40-page book—40 mailorder subjects, 25c. Eljay Publishers, Herrin 4, Illinois.

SALES Outlook terrific for "money"—new dollar book golden opportunities, moneymaking ideas, small businesses, strange patents. Most unusual book 6x9, thrilling, inspirational. Distributors wanted, full or part time, every city, county. Rush $1 for copy with exclusive big money sales plan. Pyramid Press, 218P Flatiron Bldg., Denver 2, Colorado.

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MONEY Made in spare time from hobbies. Particulars free. Alfred Halteman, 314 Willowwood Dr., Dayton 5, Ohio.

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NEW Advertising scheme—A supplement to your magazine advertising. Every mail order beginner should have it. 25c. Murray's, 196 Circle St., Forestville, Conn.

BIG Mail free—Your name printed free in big mail directory. Send 25c for 3 mo. subscription to Progressive Mail Trade magazine. Valis Mail Service, 3201 Harrison, Brookfield, Illinois.

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MONEY! Money! Money! Have you too much? Then don't write us for free details about mail order work, because you will only make more! Quivira Mail Service, 207-f North Pioneer, Lyons, Kansas.

WOULD You pay 3%—first $350 made? Color-illustrated book "505 Odd, Successful Enterprises" free! Proven by "Little Fellows." Start at home, office. Expect something odd! Pacific, 262 Drake, New Rochelle, N. Y.

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BUBBLE Formula and valuable list 10c (coin). Worth dollars. Taulman, 3316-6-G, Fort Worth 5, Texas.

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COUNTLESS Profitable opportunities as own boss. Giant illustrated instruction book contains 10,000 helps, scientific formulas, secrets. Earn immediately. $2.89 postpaid. (C.O.D. accepted). Continental Publications, 79-02m Woodside, Elmhurst, New York.

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MAKE 25 Pounds soap for 25c in about 25 minutes. Three ingredients. No lye or grease. Also bubble liquid. Carpet cleaner. Soap substitute. Garment cleaning soap. All 25c coin. Smart circular free. Teycer, Chemist, Box 1287½, Chicago 90.

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REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse, N. Y.

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PLASTICS And supplies—new Plexiglas, Lucite, and Catalin—sheets, rods, tubes, etc. Plexiglas and Lucite sheets per sq. ft. 1/16" $1.60; ⅛" $2.00; 3/16" $2.25; ¼" $2.75; ⅜" $3.75; ½" $4.75; ¾" $7.50; etc. 5% discount over 5 sq. ft., 10% over 10 sq. ft. Kits $2.00; $5.00; and $8.00. Swiss musical units—$3.95 postpaid. List free. Send money order. Plas-Met Sales and Engineering, 4648 Shirley Pl., St. Louis, 15, Mo.

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SELL Lucite hobbycraft supplies! Cooperative agency plan. Technicraft, 1156 Commonwealth, Boston 34.

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25 PROJECTS! Complete plans, instructions. Beautiful, salable Lucite novelties. $1.00. Warde, 1248 Neil, Columbus, Ohio.

IF Interested in plastics see the Jacaso advertisement on page 251.

MOLDED Plastic egg holder, (1 dozen) 8x10x1⅜"—$1.25 each. FOB Fernal's, 12449 State, Chicago 28, Ill.

WANTED—Plastics craftsman to make small ornament. R. D. Hudson, 100 Broad Street, Martinsville, Va.

YOUR Name, beautifully machine engraved, ½" letters on two inch lucite, 15c letter. $1.50 minimum. A. C. Alexander, 1813 E. 5th, Pomona Calif. 1

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PLEXIGLAS, Clear, masked, 12"x12", 1/16"—$1.50; ⅛"—$2.00; ¼"—$2.75, postpaid. Dyes, 16 colors; dye concentrate; cements, colored, clear. List free. G. Baker Company, 685 Center Avenue, River Edge, New Jersey.

PLEXIGLAS Any size, any amount, cheap. Free price list. Thomas Cavaliere, 2141 So. Beechwood St., Phila. 45, Pa.

LEARN At home "Working With Plastics," Full information on sheets, blocks, rods, tubes. Trade names, sizes, colors for fabrications, designing, tooling, bending, cementing, polishing. Also for home workshop. Only $1.25 postpaid. Money back guarantee. Modern Technical Book Co., Dept. M4MC, 55 West 42nd Street, New York 18.

PLASTIC, Plexiglas sheets new; 144 square inches following thicknesses: 1/16" $1.60; ⅛" $1.85; 3/16" $2.00; ¼" $2.50; ⅜" $3.50; ½" $4.50; ¾" $7.25; 1" $9.25. 5% discount over 5 square feet, 10% discount over 10 square feet. Sent prepaid. Send moneyorder. Plastic Supply Company, 2618 St. Louis Ave., St. Louis 6, Mo.

LUCITE—Complete illustrated fabricating instructions, used in craft classes throughout the world, price list on lucite, dyes, complete supplies. Booklet 10c, with sample, 35c. "Gem-O'-Lite," P.O. Box 686-B North Hollywood, California.

BIGGEST $1.00 Plastic value transparent plexiglas and lucite sheets and strips in irregular shapes and thicknesses. Useful for many projects and experimental work—big package by return mail, no waiting. Double size package with dye and cement included $2.00. Send money order to HomeCraftsman Plastics, 1945 W. Harrison Street, Chicago 12, Illinois.

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THE House of Winn, home of supplies for amateur chemists. See Winn's New Idea chemical kits and apparatus outfits for home experimenting. Send 10c for retail catalog. Established 1931. John H. Winn, Dept. 507, 124 West 23rd St., New York 11, N. Y.

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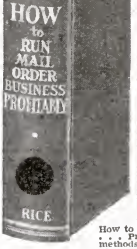

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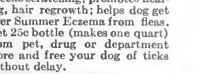

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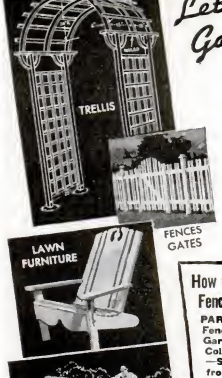

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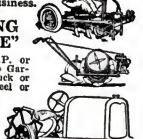

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POPULAR MECHANICS JULY 1946
WRITTEN SO YOU CAN UNDERSTAND IT
VOL. 86 NO. 1

Ears of the Sub Killers

By William T. Adams

Sonar is the ears of the Fleet just as radar is its eyes. Here is the graphic story of our undersea listening posts and how they ended the U-boat menace

ONE single technical invention by our enemies," said Hitler in 1943, "has checked our U-boats."

That was not exactly the case; a combination of new devices and tactics was responsible, and high on the list of antisubmarine devices was sonar. Sonar is the official Navy term covering all aspects of underwater sound detection. The operators are called sonarmen.

Let's step into the shoes of a sonarman and slip on his jacket with its distinctive headphone insignia. As a sonarman you've had months of training at the U. S. Navy Sound School at San Diego, New London or Key West. Now you have come aboard. Maybe it's a DD (destroyer) or a DE (destroyer escort) or an SS (submarine). There are two sides to this sonar business—prosubmarine and antisubmarine. If you're on a destroyer or a ship of that type you're out to murder subs. If you are assigned to a sub your job is to detect enemy targets.

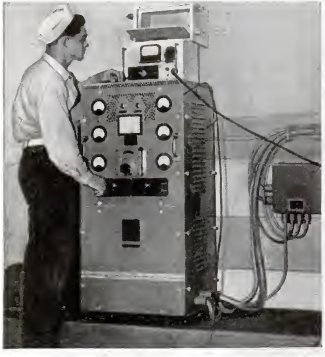
Subsurface warfare resembles a battle between two gunmen in a pitch-black cellar. They feel their way through the dark listening for every sound. The first who sneezes or bangs a washtub is probably a dead duck.

Suppose you are aboard a destroyer as sonarman, first class. Your ship is convoying troop transports well out on the port flank of the convoy. You're sitting on a

hard chair listening to pulses of sound—pings—tossed every second or two from the loud-speaker over the "stack" before you. You watch dials that record the true and relative bearings of your ship. In your hand is a small metal wheel. Slowly you turn it from port to starboard and back. As the pings go out steadily without an echo, you report to the conning officer on the bridge: "No Contact!"

Sonar is the amazing twin of radar—but less well known. Radar is the Fleet's "eyes" and sonar its "ears."

Basically, radar is a device which projects a beam of electrical energy through the air until it strikes an object that bounces back part of the electrical energy.



Checking sonar driver — source of the sound signal

Sonar control "stack" guides beam, listens for echo

Similarly, sonar transmits an electrical impulse of sound through water. If the sound wave strikes an object, an echo is reflected which is caught up by a powerful receiver. Both devices—radar and sonar—reveal range (distance) and bearing (direction).

Like all complex electronic devices, sonar is the newest expression of multiple experiments begun years ago. During World War I, the Allies developed a new instrument for detecting undersea sound called the hydrophone. This was strictly a listening device and functioned like a doctor's stethoscope. The intensity of sound indicated a sub's distance, and by skillful maneuvering the listening vessel could be brought over the sub for attack by depth charges. Soon ships began carrying two hydrophones so that U-boats could be located as to bearing as well as distance.

Of course, submarines could avoid hydrophone detection by shutting off their engines and resting quietly on the bottom. Also, submarines soon had hydrophones of their own which aided them in spotting surface craft.

Next step leading to sonar was the application of the newly invented vacuum-tube amplifier to the hydrophone. This made possible an enormous gain in sensitivity. If a number of patrol ships closed on a U-boat, the direction of the sub from each ship was radioed over and plotted by the patrol leader.

Then the American inventor Fessenden produced a new idea in underwater sound detection—the electromagnetic oscillator and receiver which was able to generate powerful sound waves in the sea. These waves radiated outward several miles in all directions like ripples from a stone cast into a pond. If the waves struck any object—an iceberg, rocky coast, submarine—part of the waves would be reflected back to the sending ship. A pickup device measured the time lag of the echo and thus gave the range of the target.

After the Armistice, several countries simultaneously developed the first modern type of echo-ranging gear.

Before the start of World War II, many of America's leading physicists, inventors and engineers plunged into the task of further extending the value of underwater sound gear. The result is present-day sonar.

Let's step back into the shoes of the sonarman to see how he operates. The room in which you work is the sonar hut—usually located on the bridge or just off it.

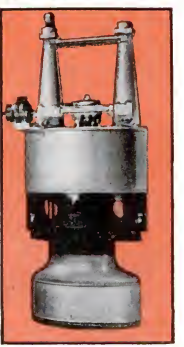
You're still turning the wheel on the stack slowly from port to starboard and

Cutaway shows sonar layout on ship from stack (controls) to retractable dome (also shown below) which sends out directional and supersonic pulse

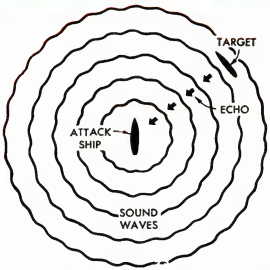
STACK
BDI
ATTACK PLOTTER
SOUND RANGE RECORDER
POWER SWITCH
POLARIZER LINE TRANSFORMER
HOIST MOTOR CONTROLLER
DRIVER RECTIFIER
FILTER JUNCTION BOX
DOME SEATING CONTROL UNIT
MAIN JUNCTION BOX
DYNAMO ELECTRIC AMPLIFIER
DOME AND RETRACTING GEAR
LOCAL CONTROL UNIT

back, calling out "No Contact" from time to time. You know that down under the hull of your ship, swirling along in the water, is a streamlined "dome" which contains a most important part of your equipment—the directional supersonic oscillator, or projector.

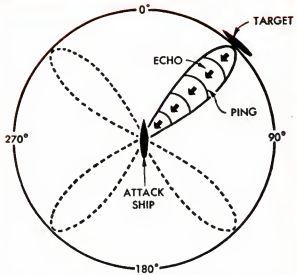
A far cry from Fessenden's early device, your projector concentrates its high-frequency pulse in a narrow cone or beam. The oscillator is really a large sandwich made of steel and layers of quartz or Rochelle crystals through which electrical currents are transmitted by the driver. This sets up frequencies over a range extending up to thousands of vibrations per second. The sound impulses carried out by the beam are supersonic. Your sending and receiving equipment change these supersonic sounds into sounds you can hear easily. The wheel in your hand and the stack which houses all controls are both connected with the projector so that, as the wheel turns, the narrow beam of sound turns with it. Since you are moving forward at fair speed, you swing (or search with) your sound beam over the two forward quarters. There is little chance of a slow-moving sub coming up on your stern quarters.



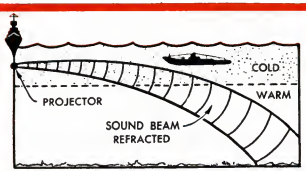
If seas are moderate and echo-ranging conditions good, you know your beam will detect objects in the water up ahead. But



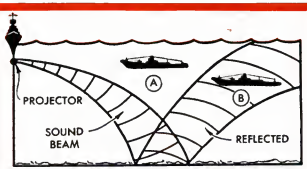
Early Fessenden oscillator sent sound waves out in all directions and returned echo was weak



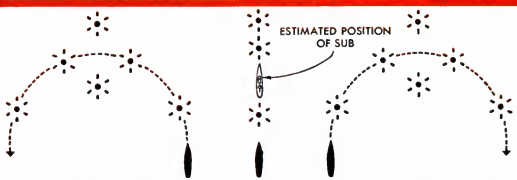
Modern sonar sends powerful directional beam; time lag between ping and echo gives the range



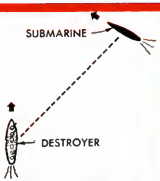
Layer of warm water "bends" sound beam downward—missing submarine only 500 yards away



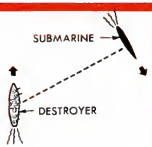
Here sound beam has hit bottom and reflected upward, catching sub B; sub A is in dead spot



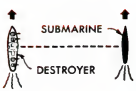
Pattern of depth charges is laid over sub by three attacking destroyers according to set plan in order to bottle up U-boat for the kill; a depth dive is the sub's only hope



"Up Doppler" (rising pitch of echo) means destroyer and submarine are getting closer



"Down Doppler" (falling of pitch in echo) means ships are gradually drawing apart



"No Doppler" (no change in pitch of echo) occurs when ships are running parallel

Sonar has done its work in locating a target for this Coast Guard crew and a depth charge churns the sea

you also know that sound transmitted in water is apt to do queer things. The sea is composed of layers of cold and warm water that reflect and refract (bend) sound waves. You learned in sound school that certain sea areas abound in crustacea, such as snapping shrimp, that raise Old Ned with echo-ranging. Charts of echo-ranging conditions for different seasons and localities are used and also readings from a device called a bathythermograph that records temperatures at various depths. If conditions turn bad the beam may be effective out to only 300 or 400 yards. You sit there straining your ears, your eyes on the control stack. The loud-speaker pings repeatedly. You turn the wheel—over and back . . . over and back . . . searching the seas . . . ever alert.

Then it comes—a faint echo between pings. "Contact!" you shout into the intercom. "Bearing zero-six-seven!"

"Verify contact," orders the conning officer. He knows, as you do, that every contact may not be a submarine. Perhaps it's a whale or a playful school of porpoise or a mass of seaweed.

Painstakingly you swing your sound beam back and forth over the narrow segment where you picked up the first echo. The ship is alerted as it heels to port. Every man is at battle station. By your side your fellow sonarmen stand at the sound range recorder. Everything now depends on you —you are the brains, the heart, of the ship. On your skill rests the fate of many.

"Contact. Bearing zero-five-zero," you call out. The echo is stronger now and you add, "Up Doppler."

This ability to recognize the Doppler effect in echoes is a vital part of your mental equipment. Without it you would never have qualified as a sonarman. Doppler effect, named for the man who discovered this phenomenon of sound, is the change in pitch of sound as you approach or draw away from the sound source. When you report "Up Doppler" it means ping echoes are rising in pitch and you are getting nearer the target. "Down Doppler" means you are losing distance. "No Doppler" means distance remains the same.

Now, at your elbow, the sonarman at the sound range recorder announces, "Range four double O." The conning officer knows that the target is 400 yards away. Another officer locates the target in relation to the convoy. If other attacking ships are combining in the operation, they are notified and a set pattern for the attack adopted according to definite rules. A constant stream of radio information is exchanged between ships since there is no danger of interception by the submerged target.

"Bearing zero-three-zero, up Doppler, believe it's a sub, sir," you report. Now you are headed 30 degrees to starboard of the target, and the range is narrowing. By the metallic quality of the echo and the Doppler effect, you feel sure this is a submarine.

"Range closing to two-five-zero," calls the sonarman at the range recorder. Next to him his companion studies the BDI (Bearing Deviation Indicator). This is a scope like the scope of a television set. On it a beam of light travels up and down a center line. Targets are represented on the

(Continued to page 244)

Nonscratch Clamp Holds Oars

Rubber-faced at contact points so that it cannot scratch the finish, a clamp fastens to the drip-mold and holds fishing poles, skis, oars and other long objects in place on a car top. It does not interfere with the closing of car doors and can be put on or taken off quickly by tightening or loosening one wing nut. Once attached the metal clamp will not be shaken loose by wind or vibration.

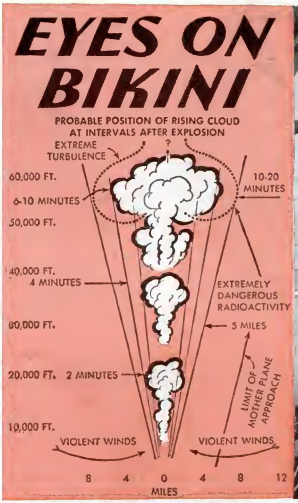
Steamed Upholstery Is Wrinkle-Free

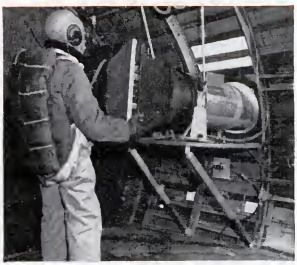
Much as a tailor uses steam in pressing a suit of clothes, an automobile manufacturer is employing it to achieve a glove-like fit of the upholstery in his 1946 closed models. As the automobile bodies come along the Hudson production line at the factory in Detroit, steam under 400 pounds pressure is fed into the closed body for 12 seconds. When the doors are opened the "steam-fitted" seat covers are smooth fitting and wrinkle-free.

Tank Pulls Stumps

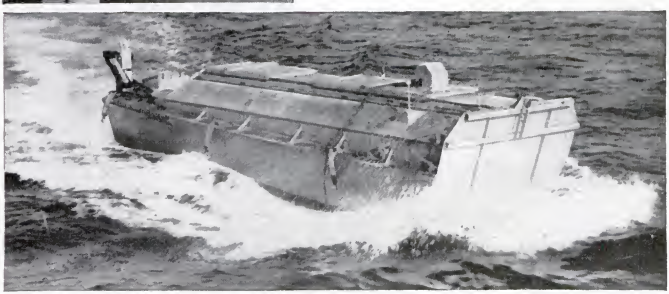
When the Army declared a group of tanks surplus, Kamile Dupre purchased one at the Rock Island arsenal. He uses it to pull huge tree stumps from the fields on his farm near Geneseo, Ill., and for other heavy farm chores.

¶ One million children in the United States, not including the totally deaf, are suffering from some form of poor hearing, according to estimates of the American Society for the Hard of Hearing.

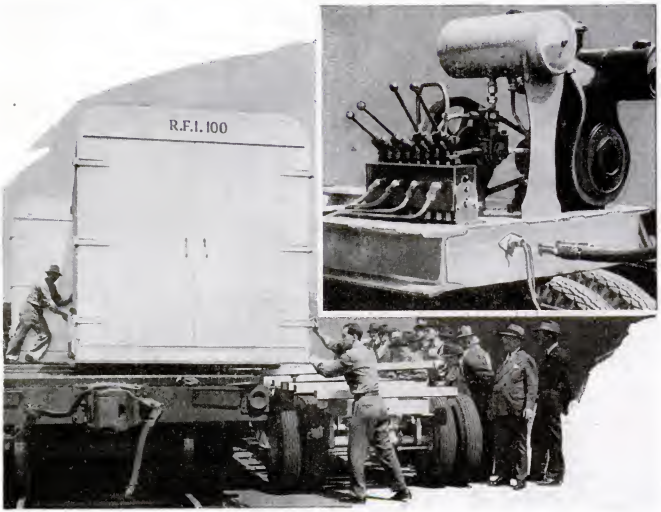




Batteries of cameras like those above are expected to give "Operation Crossroads" at Bikini Atoll this month the greatest aerial photographic coverage of all time. More than 250 movie cameras alone will be airborne for the event. A cluster of six high-speed cameras can be seen in the center background. At left is the largest single camera ever used on an operational mission, a modified K-18 with a specially designed 48-inch telephoto lens. Object of much study are the atomic clouds which will arise after the bomb explodes. The sketch, upper left, released by Joint Army-Navy Task Force One, shows the expected behavior, with violent winds at the bottom of the mushroom and extremely dangerous radioactivity at 50,000 feet. Crewless and manned only by radio waves from a "mother" vessel, Navy LCVPs like the one below will be sent into the bombed area to gather test data immediately after the explosion



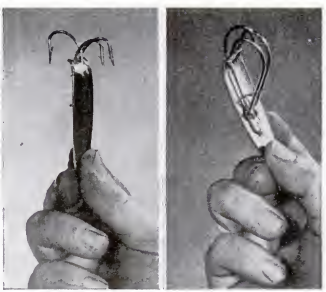
"Canned" Freight Is Transferred From Flatcar to Truck



Preloading of railroad freight cars is possible with all-aluminum containers of half-boxcar capacity. The containers are loaded in manufacturing plants and hauled by semitrailer truck to a railroad siding. Built-in hydraulic jacks, powered by the truck engine, and roller bearings shift the half-boxcar "package" to a flatcar or vice versa in just three minutes. Two 20-foot-long containers or three 13-foot containers, designed for air or rail transport, can be fitted on a flatcar. Use of the metal package eliminates rehandling of cargo between the factory and final destination. The unit, produced by the Reynolds Metal Company, can be built as a refrigerated container which holds a zero temperature for 36 hours without re-icing.

Fish Are Fooled by 'Minnow' Hooks Which Spring Open When Struck

Three camouflaged hooks on a minnow-like, nonspin, weedless spoon spring open when a fish strikes, increasing the fisherman's chances for a catch. The all-metal, chromium-plated spoon is available in two sizes—½-ounce with a 2¼-inch blade and ¾-ounce with a 3-inch blade.



DDT Tape to Kill Houseflies Retains Potency for Months

Paper strips coated with DDT compound are useful in killing houseflies. The strips are gummed at one end to simplify hanging them from the ceiling. Flies absorb DDT on contact and die shortly after. The tapes are effective for several months if kept out of direct sunlight.

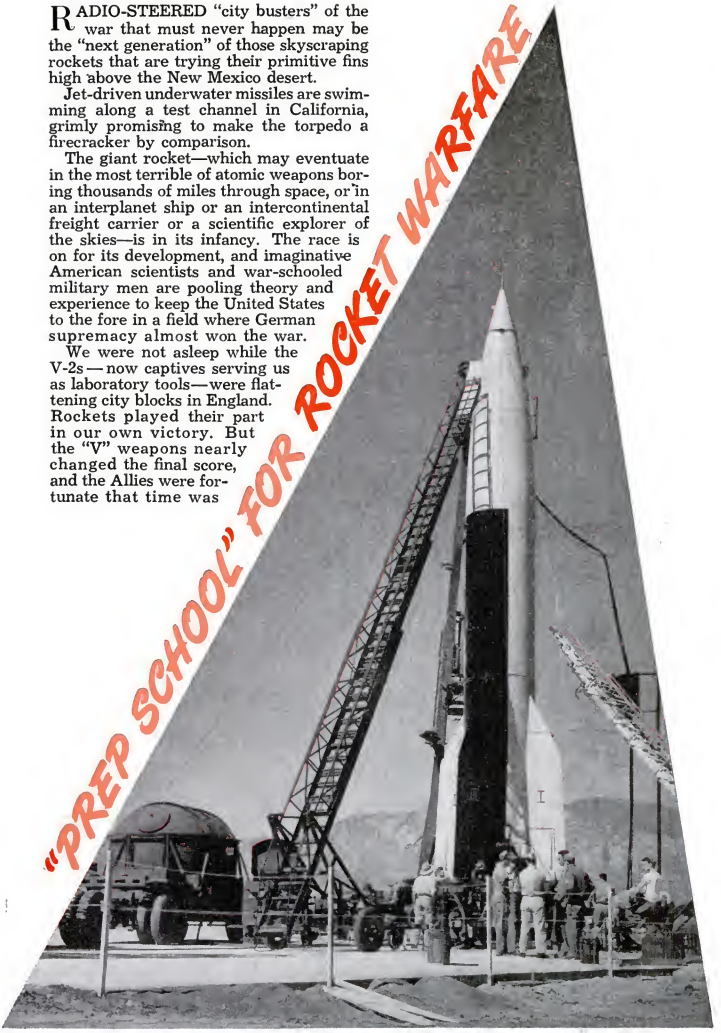
"PREP SCHOOL" FOR ROCKET WARFARE

RADIO-STEERED "city busters" of the war that must never happen may be the "next generation" of those skyscraping rockets that are trying their primitive fins high above the New Mexico desert.

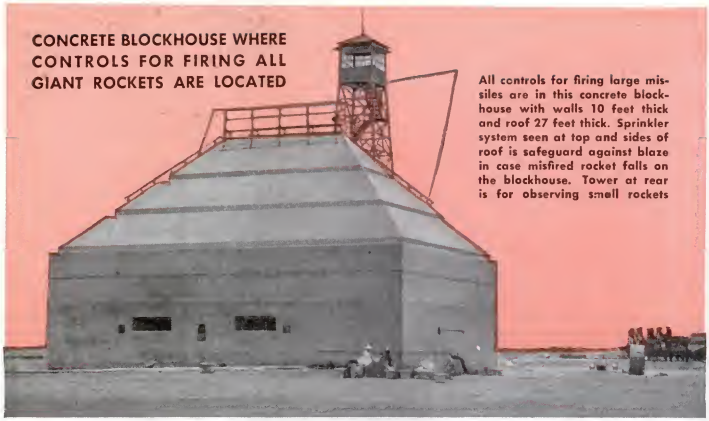
Jet-driven underwater missiles are swimming along a test channel in California, grimly promising to make the torpedo a firecracker by comparison.

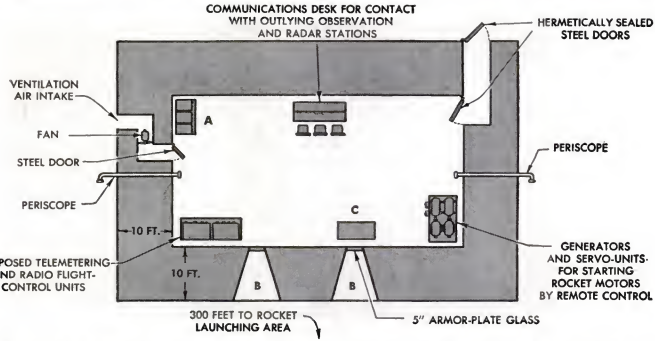
The giant rocket—which may eventuate in the most terrible of atomic weapons boring thousands of miles through space, or in an interplanet ship or an intercontinental freight carrier or a scientific explorer of the skies—is in its infancy. The race is on for its development, and imaginative American scientists and war-schooled military men are pooling theory and experience to keep the United States to the fore in a field where German supremacy almost won the war.

We were not asleep while the V-2s — now captives serving us as laboratory tools—were flattening city blocks in England. Rockets played their part in our own victory. But the "V" weapons nearly changed the final score, and the Allies were fortunate that time was



V-2 on New Mexico firing platform is fueled by liquid oxygen-alcohol blend carried in two 1000-gallon tanks





A Apparatus to establish time base for all stations observing rocket's flight in trial

B Soldier peers from outside at five-inch-thick armored glass protecting an observation slit

C Firing of all large missiles is directed by operators at this panel in the blockhouse

too short for the Nazis to learn all that we now are learning of long-range missiles.

Already we have plans for static test stands to try the motors for 150-ton rockets that are being conceived in current research programs. Other rockets that can race to the upper limits of the atmosphere and relay weather information back to earth, supersonic "test tubes" that will investigate new airfoil shapes, radar-tracked and radio-guided rockets all are close to realization.

Before he relinquished leadership of the AAF, General H. H. Arnold warned Congress of the need for an intensive research program: "If we fail to keep not merely abreast but ahead of technological development, we needn't bother to train any force and we needn't make any plans for emergency expansion. We shall be totally defeated before any expansion could take place!"

This summer at White Sands, New Mexico, Proving Grounds the Army Ordnance Department is experimentally firing a series of German V-2s up to the 100-mile level above the earth, well beyond the heights their inventors achieved. These nearly 14-ton giants, pointed skyward on a concrete launching platform, emit fire like a blast furnace and leave the ground with the roar of 100 express trains.

The rocket takes off slowly at the speed of a building elevator but accelerates rapidly and is moving 3000 miles per hour within a minute. It reaches maximum velocity of 3800 miles an hour at a point about three quarters of the way in its path of descent, finally crashing in the impact area, 30 to 40 miles away, its fuel explosion alone gouging a crater 35 feet across and 25 feet deep.

Controls for the firing are located in a concrete blockhouse some 300 feet away, with walls 10 feet thick and a 27-foot-thick roof. The rest of the area is cleared and a rocket shell fired from the blockhouse signals the outlying observation stations two minutes before the hulking V-2 is sent on its way. Painted a glaring yellow and black to aid observation, the finned cylinder is as high as a three-story building.

The giant V-2 missiles and rocket air-

"WAC Corporal" in position at bottom of 102-foot steel launching tower. The rocket weighs nearly 700 pounds and is 16 feet long. Standing alongside is Dr. Frank J. Malina, Cal Tech scientist who developed fuel now used to fire it nearly 50 miles up

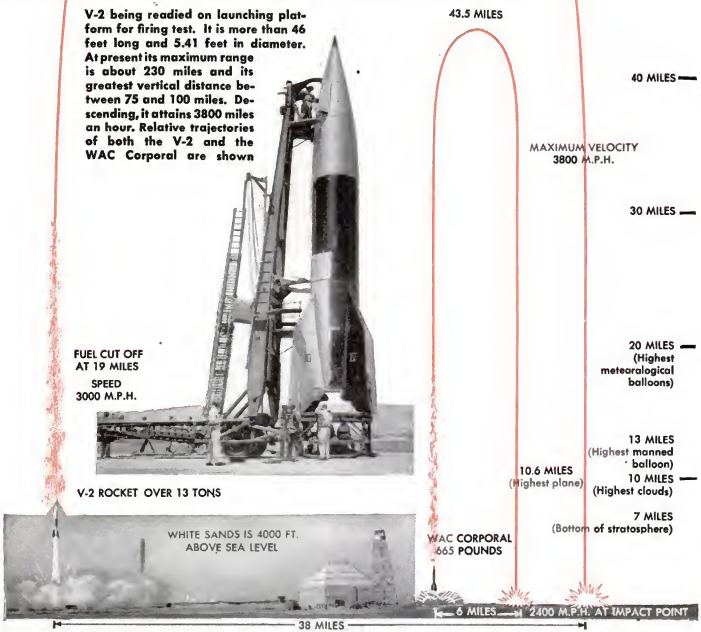
craft were two of Germany's major jet propulsion achievements during the war. The United States, meanwhile, concentrated on short-range artillery and aircraft rockets that were most suitable to our immediate military needs. But all the while, under wraps, we were working on advanced types in the longer-range categories.

Much of this research was centered at a secret 40-acre laboratory area near Pasadena, Calif., operated by the Jet Propulsion Laboratory of the Guggenheim Aeronautical Laboratory of the California Institute of Technology. Here scientists invented and perfected the JATO (jet-assisted takeoff) units by which heavily-loaded military aircraft are boosted into the air after very short runs. Here, too, they developed the various GALCIT solid grain propellants for a variety of propulsion purposes. Cal Tech also is experimenting with new liquid propellants and with various kinds of radio controls.

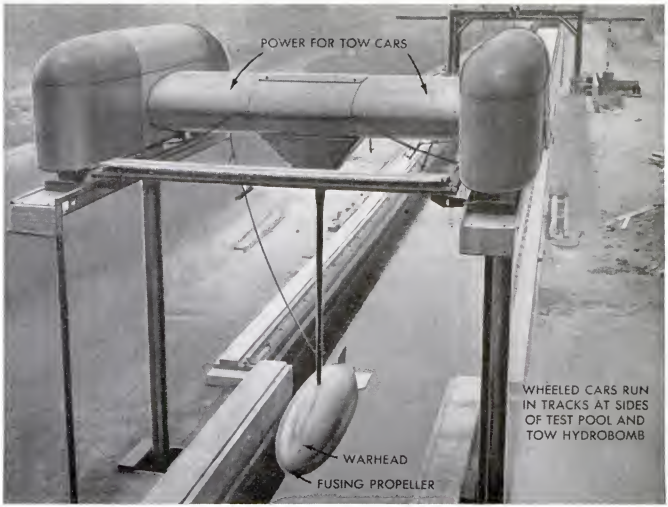
The institute's jet propulsion program for the armed services was initiated by Dr. Theodore von Karman. At present Dr. C. B. Millikan is acting chairman of the executive board and Dr. Frank J. Malina is acting director of the Jet Propulsion Laboratory.

Three million dollars have been spent for explosionproof observation rooms, concrete firing pits in which rockets are anchored for stationary tests, a towing channel for the study of underwater jet-propelled missiles, and other special equipment.

The project personnel operate a test station for the Ordnance Department of the AAF Muroc Army Air Base, Calif., where a firing pit large enough for the testing of liquid propellant rocket motors of up to 20,000



V-2 being readied on launching platform for firing test. It is more than 46 feet long and 5.41 feet in diameter. At present its maximum range is about 230 miles and its greatest vertical distance between 75 and 100 miles. Descending, it attains 3800 miles an hour. Relative trajectories of both the V-2 and the WAC Corporal are shown



Hydrobomb tests are made in this 500-foot tank with underwater observation windows. The electric-powered tow car is lowered to the tracks at either side of the tank, completely straddling it when in operation. Still experimental, this plane-borne supertorpedo can carry a heavier charge twice as fast as current types

pounds thrust has been constructed. A motor of this size consumes propellants at the rate of three tons per minute.

Among the moderate-range experimental missiles developed at Cal Tech were the eight-foot-long needle-nosed "Private A" that has a range of 11.3 miles, and the "Private F," similar to "A" but equipped with horizontal lifting tail surfaces of nearly five feet span plus stubby nose wings of less than three feet span. They were designed for studying guided missiles.

For the Ordnance Department the project built the "WAC Corporal," code name for an upper-air sounding rocket that has been tracked by radar to an altitude of 43.5 miles. It carries meteorological instruments in its long needle-point nose.

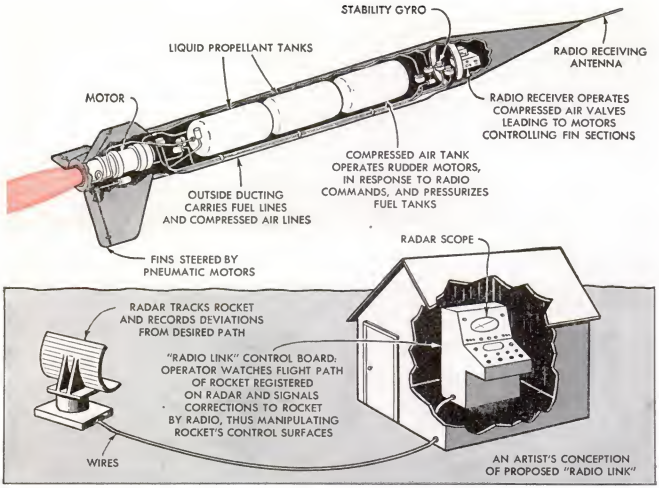
The WAC Corporal is 16 feet long, a foot in diameter and weighs less than 700 pounds. It is launched vertically inside three guide rails contained in a 102-foot-tall steel tower. Initial acceleration comes from a booster unit that delivers 50,000 pounds of thrust for a little more than half a second. An inertia-operated valve then turns on the main motor that delivers 1500 pounds of thrust for a total of 45 seconds. This drives the missile almost 50 miles up.

The booster unit consists of an adapted motor of a "Tiny Tim" rocket, originally designed to be launched from an airplane and delivering the punch of a 12-inch naval shell. It was developed at Cal Tech and was used at Okinawa.

The propellant mixture in the WAC Corporal consists of a fuel and an oxidizer, each in a separate tank, that combust spontaneously when brought together in the combustion chamber. Aniline is used as the fuel and nitric acid is used as the oxidizer. This combination, developed under Dr. Malina, automatically ended ignition, combustion and "throbbing" problems earlier encountered with liquid propellants.

Compressed air pressure feeds the propellants into the combustion chamber. The jacketed chamber is cooled by the flow of the aniline en route from its storage tank.

Much work is being done on liquid propellants. The present acid-aniline combination is superior to an earlier nitric acid and gasoline mixture that was ignited by a spark plug in the combustion chamber. New discoveries in turn may supersede acid-aniline. One oxidizer that has promise is a high-strength hydrogen peroxide. A nitromethane monopropellant, too, is being used experimentally in small rocket motors for periods as long as five minutes.



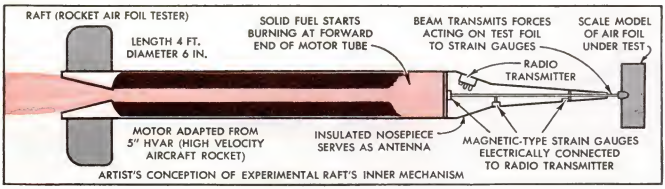
One American technique has been to force the propellants from their tanks to the combustion chamber by means of compressed air. The Germans used this and also developed the turbo-rocket system, used in the V-2, by which gas obtained from hydrogen peroxide operates a turbine that pumps the propellants from their tanks. Research is continuing on these systems and also on a way of manufacturing pressurizing gas from chemicals placed in the rocket.

Cooling the rocket motor is another problem. The best method so far has been to circulate the liquid propellant around the motor to absorb the heat. Under investigation is a proposed "film cooling" method by which the walls of the combustion chamber and exhaust nozzle are coated with a film of liquid. It may be that the evaporation of this film during combustion will keep the walls at a satisfactorily low temperature.

Another weapon that Cal Tech is working on experimentally is the hydrobomb, designed to be dropped from an airplane and to travel under water like a supertorpedo. A jet propulsion motor gives the hydrobomb an underwater speed of 70 miles per hour, twice the speed of the usual Navy torpedo. It carries a much heavier charge than a torpedo but has a shorter underwater range.

The hydrobomb is almost 10 feet long and has a diameter of 28 inches. Its motor is similar to a JATO unit.

For testing the hydrobomb a water tank 500 feet long, 12 feet wide and 16 feet deep was built at the experimental area. The tank has an underwater window through which the performance of the missiles may be watched and recorded. A rocket-propelled tow car was placed astride the channel. Electric motors that give the tow car



ARTIST'S CONCEPTION OF EXPERIMENTAL RAFT'S INNER MECHANISM

a speed of 40 miles per hour have since replaced the rocket power.

Another of the Cal Tech projects is the RAFT, a rocket apparatus intended to move an experimental airfoil at the speed of sound, or at supersonic speeds, in order to measure its aerodynamic characteristics and report them by radio. Its name is taken from the initials of the designation "Rocket Air Foil Tester." It will augment and check wind tunnel studies on new wing shapes by actually flying them at speeds approximating those for which they are designed.

Present experimental RAFTs consist of standard five-inch High Velocity Aircraft Rockets fitted with a special type of nose. Almost six feet long, the standard HVAR rocket travels just under 1000 miles per hour without an airfoil attached.

The airfoil under test is supported in front of the rocket's nose by means of a rod or beam. The other end of this beam is supported at three points inside the nose of the rocket. Lift, drag, and moment that act on the airfoil in flight are registered at these three points by magnetic strain gauges.

A novel radio hookup relays this information to the ground. Each of the strain gauges controls the frequency of an audio-oscillator circuit. Variations in strain thus create comparable variations in frequency. The nose of the rocket, insulated from the motor, serves as a half-wave-length antenna to transmit variations to the ground, where they are received and recorded.

To keep their huge V-2 missiles on their intended courses the Germans provided automatic pilots with three gyroscopes to control the pitch, yaw and roll.

At Cal Tech, ORDCIT men (Ordnance Department and California Institute of Technology), in conjunction with the Sperry Gyroscope Company, are working on automatic pilots of greater accuracy and more positive control. They are experimenting with telemetering systems by which a rocket reports information about itself to the ground, and on "radio link" control apparatus by which a missile may be maneuvered and directed during flight.

A typical automatic rocket pilot consists of three air-operated gyroscopes connected to pneumatic motors that are geared to the steering segments of the rocket fins. When the rocket veers from its course the gyro mechanism signals the motors, which then operate the rudders sufficiently to bring the missile back on course. The gyros, amplifiers and motors all are driven by compressed air from the tank supplying pressure to the propellant tanks.

Telemetering is new and complex. It reports 10 conditions continuously to a ground station during the flight of the rocket.

(Continued to page 260)

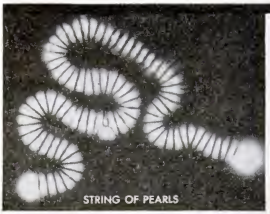
Dummy Tests "Charging Power" Of Football Linesmen

Football coaches can measure in pounds the charging power of linesmen with a practice dummy devised by Ed Ryan, coach at Klamath Falls, Ore. It is a cross between a conventional dummy and a carnival punching bag that tests your "hay maker." The machine has springs and levers connected with a meter to measure the force with which the dummy is hit.

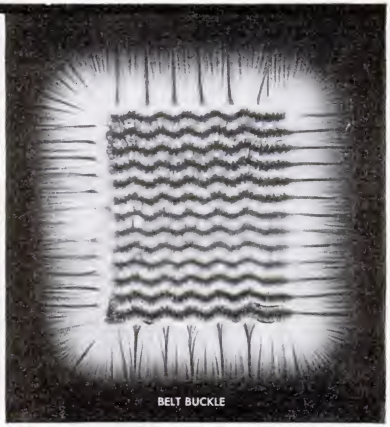
Quick Lock Hose Coupling Is Held Tight by Spring

Hose couplings that any housewife can handle with ease are made of solid bar aluminum that resists wear and corrosion. The threaded section is attached permanently to any standard threaded faucet. The section attached to the hose has a knurled ring instead of threads. When the ring is moved, a set of hinged dogs swings open and grips the faucet section. Moving the ring back against the pressure of a spring releases the dogs for uncoupling the hose. Standard types of gaskets can be used with the new coupling.

Photographs Made Without Camera by Electrical Charge


STRING OF PEARLS

PAPER CLIPS


BELT BUCKLE

Weird looking photographs can be taken without a camera. An object, such as a necklace, is placed on a photographic plate in a darkened room. Electric wires are attached to each end of the object and the current is switched on. The electricity passes through the object, creating an aura of light which registers on the photographic plate in the form of a strange pattern. In a recent experiment, 100,000 volts was used.

Home Churn Attachment Makes Butter in Washer

Butter now can be churned in the washing machine. A churning device clamps on either a round or square-type washing machine agitator. It holds two one-quart canning jars. The jars are partly filled with cream and the machine turned on. The rest of the process is automatic and requires no attention until the freshly churned butter is removed.

Welder Charges Battery

Battery charger and arc welder are combined in one unit designed to service railway coaches. One model is equipped with a 400-ampere electric motor-driven welder and circuits for charging batteries on two coaches at a time at a maximum rate per battery of 150 amperes at 50 volts d.c. The unit is adaptable to any shop where batteries are charged and electric arc welding is done.

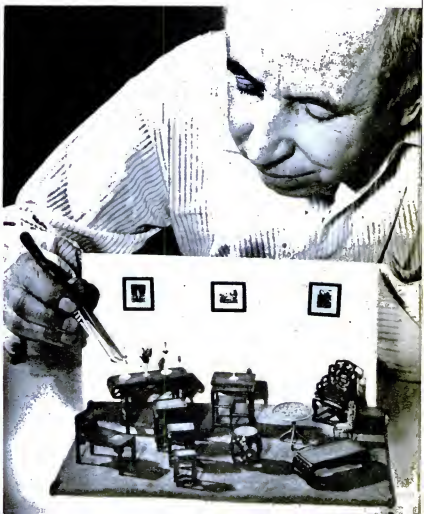
Tailored for TOM THUMB

Kitchen match is big timber in tiny miter box. The pipes can be smoked

6117 N. Winthrop Chgo 40.

If you need a complete set of carpenter's hand tools all carefully made from the finest materials you can find them at the home of Joseph H. Gray in Chicago. But you'll have to be less than a foot tall or you will not be able to use any of them. Just how many thousands of miniatures he has in his collection, Mr. Gray himself doesn't know, for he is still collecting. But he could furnish a home for an undersized Tom Thumb with fine period furniture, carpets and original etchings, even including folders of tiny safety matches for lighting the half-inch candles in the inch-high candlesticks he is arranging carefully on the table below

It's a midget hammer, not a nail, alongside regular hammer, left. Every tool in miniature chest will work



Promoter: John Bellion Oaechner
100 Cooper St. NY 34, NY.

Mechanical Waiter in Restaurant Table Lifts Food From Kitchen

Waiters in a New York restaurant are never tipped—because they're machines. Mechanical service tables have been installed that are connected by miniature elevators with the floor below. The diner writes his order on a slip of paper and drops it through a slot in the table to the kitchen. There a chef prepares the order and places it on the elevator. It then is raised to the diner through a hole in the center of the table.

Penicillin Output Increased

Greater yield through improved methods of production has caused the wholesale price of penicillin to be reduced from $20 per dose in June 1943 to its present level of about 60 cents. During the first six months of 1943 only about 400 million units were produced, enough for about 400 cases. In the last six months of 1945 production each month was 677 billion units. Money value of this lifesaving drug produced last year is estimated by the Department of Agriculture at $100,000,000.

Sharper Beam for Radio Relay Aids Phone Systems and Television

Ultrashort radio waves are focused into a sharp beam by a metal lens which is expected to have widespread application in microwave radio relay systems such as the New York to Boston channel now under construction. The lenses, varying from 18 inches to 20 feet in diameter, were designed primarily for long distance telephone transmission. They also will be used in transmitting wire photos, for radio broadcasts and television programs and as an aid to radar for sea and air navigation. Developed by Dr. Winston E. Kock and his associates at Bell Telephone Laboratories, the lens improves the transmission and receiving of wave energy in the form of a narrow beam necessary for short-range transmission between relay stations. The lens operates on a principle somewhat akin to that of a simple magnifying glass focusing the sun's rays to burn a hole in a sheet of paper. An array of metal plates receives radio waves from a hornlike shield and focuses them into a pencil beam.

Information about products described in this issue may be obtained by writing to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Ill.

Pleasure Float for Bathers Can't Capsize or Sink

Bathers can lie back, float and relax under the sun-shading canopy of a nonsinkable pleasure raft. Built in various sizes to accommodate up to four persons, the raft is made of a cork compound in two sections joined to form the horseshoe-shaped outer shell. The body rest is of canvas tape which can be replaced by a waterproof canvas sheet if the user desires to stay dry. A gum rubber head-rest is placed at the rudder end. It is so designed that additional body rests can be attached, turning the pleasure craft into a double decker. It can be propelled by oar or outboard motor or the detachable canopy can be used as a sail. The outer shell sections can be separated quickly and the entire raft can be carried in a canvas bag. Overall weight of the craft is 55 pounds.

Square-Tip "Windmill" Propellers Designed to Boost Airplane Speeds

Resembling a windmill vane, the first square-tipped propeller blade since the days of the Wright brothers is now in production. Its builders maintain that the square tip, carrying the airfoil section for the blade's entire length, performs more efficiently because it is unnecessary to distort airfoil design at the tip as with the present blade. Width added at the tip also affords the greatest gain in blade power absorption with minimum weight increase, permitting lighter blades. A slightly rounded early version of the square-tipped blade was first used on the P-51 Mustang and new models are slated for the Martin 202 and the Consolidated-Vultee 240.

Sound "Radar" Probes Skies To Predict Weather

Meteorologists now aim machine-made sounds at the sky and study the echoes in an electrical instrument to learn more about approaching weather conditions. The sound maker, called "sodar," creates a low-power noise that can be heard as it heads straight up into the atmosphere. The same device, developed by Bell Telephone Laboratories, "catches" the returning echoes and changes them into visible oscilloscope patterns. Changes in temperature overhead are detected when the sound bouncing back is louder than when it started. This indicates that hot and cold air are mixing violently, presaging a storm.

Garden in the

Derelict house is silent evidence of the earth's thirst. Scene at top shows how water will cause the arid region to bloom

A mighty river will lift itself uphill and change a million acres of wasteland into 17,000 fertile, individually owned farms

By Thomas E. Stimson, Jr.

GRAND COULEE DAM, busy creating power for the Northwest, is being readied for its other prime task—that of manufacturing millions of tons of food every year.

When its new power tools are ready the dam and the Columbia River that it controls will be responsible for the production of vast stores of wheat and cereals, many thousands of tons of milk, butter, cheese and eggs, tremendous quantities of meat and an untold tonnage of fresh vegetables.

It will create all this by bringing under irrigation more than a million acres of rich land that is now too arid to be farmed. This amounts to adding to the useful lands of the country an area comparable to Denmark.

Administered by the Bureau of Reclamation, the $277,000,000 Columbia Basin irrigation project is planned ultimately to provide permanent occupations for more than a quarter of a million people. An estimated 80,000 will operate the 17,000 or more 40 to 160-acre new farms, and 200,000 more will work in new towns and industries.

Desert

Grand Coulee Dam will furnish power to lift part of the river to a balancing reservoir

Plans call for the nation's largest postwar construction program to complete the reclamation job in 10 years.

The project area in south central Washington is 50 miles wide and 80 miles long. The soils are deep, fertile sandy loams and silt loams. Not all the land can be farmed because several mountain ranges interrupt the area. In summer it is hot with a period between frosts of from 135 to 190 days, depending on location. Winters are generally mild with minimum temperatures of 20 degrees above zero. Rainfall varies from less than six to a maximum of nine and a half inches a year. The land will receive an average of four acre feet of irrigation water each year.

In comparable irrigation districts apples, peaches, cherries, alfalfa, cereals and forage crops, potatoes, asparagus and sugar beets all flourish along with dairy and beef cattle, hogs and sheep. Farming that combines livestock and crops seems to have greatest promise.

Before this desert can be irrigated the Columbia must be tricked into making some of its water flow uphill. This will be done by using a portion of the river's own

Farmer adjusts the head gate of canal sluice box to control amount of flow of life-giving water to dry fields

hydroelectric power to pump part of its flow up to a gigantic reservoir. From there the water will be diverted to the irrigation district many miles away.

Two factors make this engineering stunt practical. The first was a glacier which once blocked the Columbia at about the spot now occupied by Grand Coulee Dam. This forced the water to carve out a high channel through one canyon wall, at right angles to its old streambed. Eventually the glacier melted and the river resumed

Grand Coulee, prehistoric river bed carved out and then abandoned by the Columbia, will become huge reservoir

A half mile away, a cableway operator guides the controls which launch a 22-ton Bureau of Reclamation tug, left, in the waters below Grand Coulee Dam. Right, power switchboard through which power is fed to pumps

its original, and present, course. Its temporary channel was left as a huge, high and dry gulch through the tableland.

This old trench is Grand Coulee. It is to be closed at each end by earth dams 27 miles apart. It will be filled by pumping water up from the reservoir behind Grand Coulee Dam, 280 feet below. Then it will be used both as an equalizing reservoir and as a channel for conducting water part way to the irrigation district.

The second factor is that the high-water period on the Columbia occurs during the summer months. This happens because the river's water comes from Canadian ice and snow fields melted only by the summer sun. Thus adequate water for irrigation plus the power to pump it uphill can be extracted from the river's surplus flood water just at the time it is needed. This will reduce neither the power generated at the dam nor the amount of river flow at periods of low water.

Part of the pumping plant was built concurrently with Grand Coulee Dam because much of the construction is below the water level of the reservoir behind the dam. Water is to be pumped from the main reservoir up to the balancing reservoir through a dozen 12-foot-diameter steel pipes, sections of which are now in place. Six of the 108,000 kilowatt generators at the dam will supply power to operate twelve 65,000-horsepower synchronous motors. Each motor will drive one single-stage pump in one of the intake pipes. Each pump will deliver in 24 hours a little more than a billion gallons of water, more than the requirements of the seven million inhabitants of Greater New York. The pumps, which will be the largest in the world, have not yet been built.

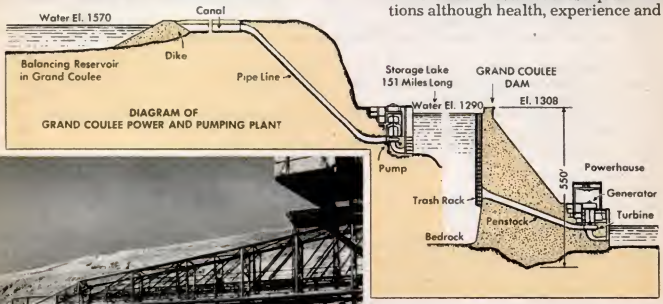
The irrigation system when completed will include 488 miles of canals and laterals, five miles of tunnels, 66 siphons to carry water across depressions, and a number of storage dams, the largest of which will be three miles long with an estimated volume of 12 million cubic yards of earth and rock fill. Seepages from the canal system and from the irrigated areas will be recovered and returned to use.

Ninety percent of the land in the area is privately owned. Appraised values on a dry land basis range from $5 to $30 an acre, depending on soil, slope and other features. These dry land values will be the basis of the price to be paid by settlers who purchase blocks of land from present owners or from the government, which expects to purchase privately owned land, divide it into family-sized farm units and resell it.

Purchase of these tracts will be an orderly procedure and there is no advantage in hurriedly buying land before the water is available. Stringent rules have been set up to prevent speculation. No homesteads are available.

An average charge of $85 per acre, depending on its productivity, will be levied

Through 12 huge tunnels, shown under construction above and below, 50 tons of water per second will be lifted 280 feet over canyon walls from the lake to fill the irrigation reservoir



against the land by the government to repay part of the cost of the irrigation development. This sum will be divided into annual payments without interest over a 40-year period. These annual payments plus operation and maintenance charges for delivering water to the land will average less than $5 per acre per year, according to present estimates.

Each family may purchase only one farm unit to which water will be delivered. The average farm unit probably will not exceed 80 acres although some lands may be available in 160-acre blocks. Generally, applicants to the government for the purchase of family tracts will be considered on the basis of general health, at least two years of actual farming experience, and the possession of $2000 or more in cash, livestock, equipment or other assets suitable for carrying on farm operations.

Purchasers of land from private owners need not meet these qualifications although health, experience and money for farm operations are considered necessary for success. The Bureau of Reclamation plans only to furnish irrigation water and oversee the orderly settlement of the region. There are no provisions for providing houses, domestic water or electricity. Cheap power will be available from Grand Coulee Dam and it is expected that settlers will dig wells to provide themselves with domestic water.

Anyone who is interested in the project and especially in the purchase of specific tracts of land should apply to the Bureau of Reclamation, Coulee Dam, Washington, for free information before incurring any obligation.

Related service industries which will come into being along with the

Cliff where power drills, above, opened pumping tunnels is now under water. Right, view inside the steel case surrounding one of the hydroelectric power units

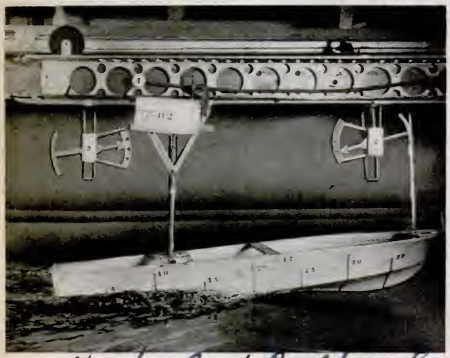
farms are certain to attract many more thousands of persons. Power for these industries will be produced by the utilization of the economic assets of the Columbia River. In its 600-mile course from the Canadian border to tidewater it falls 1290 feet and the tremendous weight of its flow can generate millions of kilowatts of electricity.

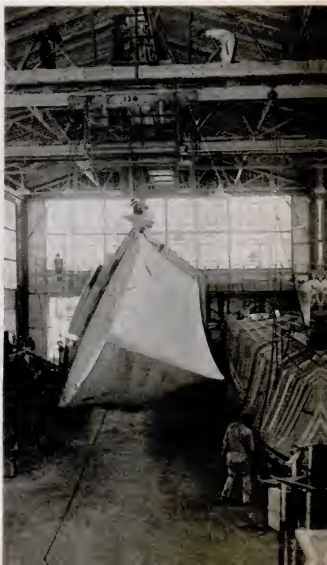
In the long-range development program a series of 10 dams is planned for the Columbia. Only two, Bonneville and Grand Coulee, have been built. The dams will convert the river into a series of gigantic steps and will utilize for power and other purposes about 92 percent of the river's fall. Barge locks for river commerce and fish ladders for Columbia River salmon will be provided at each dam, right up to the massive bulk of Grand Coulee.

If related projects such as dams on the Snake River and other tributaries are included it is estimated that the waters of the Columbia basin can be made to develop more than eleven and one half million kilowatts of power. Such a construction program will require 20 years and will cost in excess of one billion dollars. With Columbia River power the Pacific Northwest may become one of the richest and most productive areas in the world.

From PT BOAT *To* SPORT CRUISER

Ideas and mass production methods that were developed for the PT boats and aircraft rescue craft (above) are now being incorporated into a 40-foot pleasure cruiser. Sleek, war-matured lines give the boat a top speed of 40 miles per hour. The Harbor Boat Building Company of Los Angeles is building the craft on the same jigs and assembly lines that turned out the power-packed PTs. At lower left is shown the testing tank where scale models of the pleasure cruiser are checked for speed, resistance and flotation factors. Turnover assembly line below makes it possible to reach any part of the hull. The high chine (bilge) construction in the hull cushions the boat against buffeting in rough water





Harbor Boat Building Co.
Terminal Island.
Calif.

With Power Scoop Attached Tractor Becomes Earthmoving Machine

Power provided by a hydraulic pump operated by the tractor engine drives an earthmoving scoop which will dig, carry, dump and spread its loads. The scoop cuts from one to 12 inches into the ground. It holds about 10 cubic feet of earth and fills itself in three to four feet of travel, depending on the depth of the cut. After it is filled, the scoop is raised to permit forward or backward movement of the tractor. The unit is available for several makes of tractors.

Portable Packaging Machine Seals Odd-Shaped Articles in Pliofilm

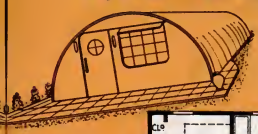
Steaks or chops, poultry or fish, vegetables or bread, hardware or precision instruments all are wrapped in individual airtight Pliofilm containers by a versatile packaging machine developed by the Goodyear Tire and Rubber Company. The machine passes Pliofilm over electrically heated rollers and between two high-speed Airfoam belts which cushion the Pliofilm tightly around surfaces of the object, at the same time forcing all air from within the formed enclosure. The machine is portable and can be taken into the field to wrap vegetables.

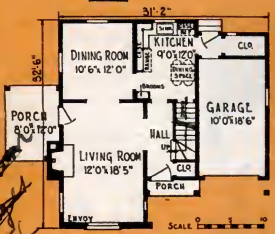
British "Jungle Airborne Buggy" Pulls Detachable Floating Trailer

"Jab" is short for Jungle Airborne Buggy, the proper name of a military car which is a British version of the American jeep. Like the jeep, the jab has four-wheel drive but it is smaller, lighter in construction and has less power. The jab can climb a sharp grade. It is powered by an eight-horsepower engine and has a floating trailer designed for ferrying over streams.

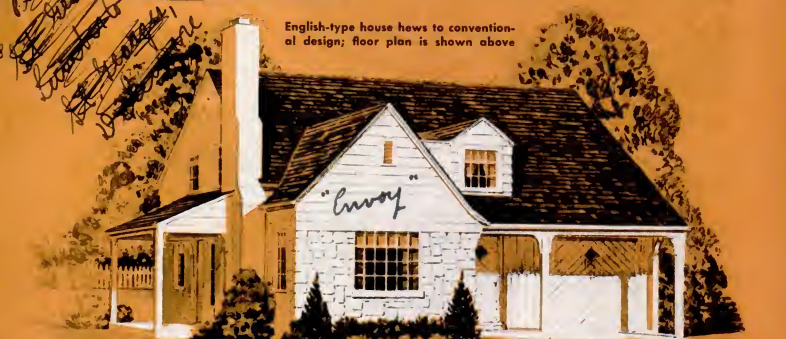
British Combine Photos Ltd.
271 Madison Ave. N.Y. 16 N.Y.

What kind of a House do you want?





English-type house hews to conventional design; floor plan is shown above



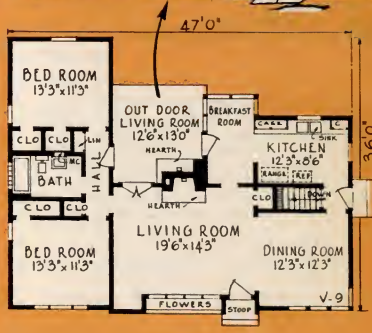
National Plan Service, Inc.
1315 W. Congress St.
Chicago, Ill.

By Wayne Whittaker

THERE will be 2,700,000 new houses along the highways and byways of the U. S. A. within the next couple of years if everything goes according to the well-laid plans of national housing experts. Wilson W. Wyatt, national housing administrator, estimates the shortage of homes at three million and the National Housing Agency says 10 million houses now standing are in such bad shape they should be torn down.

What will the bulk of the new houses be like? Flat-roofed and modern? Colonial? One-story ranch type? Wood, brick, aluminum, stucco or concrete? Prefabricated? With or without basement? With or

Spreading ranch-type home features outdoor living or dining room shown in sketch and in floor plan below



without radiant heat and air conditioning?

Out of the general confusion that has accompanied the country's awakening to the worst housing shortage in history has emerged the following conclusion: The dream era in housing is over and there's no time to wait for the House of Tomorrow. Returning servicemen and other thousands of would-be home builders are asking, "What about the House of Today?"

Since the turn of the century there have been five predominant fads in the design of houses in this country. The "gingerbread" style of architecture of the '90s carried over into the early 1900s. From 1910 to 1913 Frank Lloyd Wright houses with many horizontal windows and skylights and projecting eaves came into vogue, and after World War I (1919-1924) the English and colonial types (Dutch, Cape Cod, New England) prevailed. The fad from 1926 until the stock market went kerplunk was the Spanish house of stucco and tile with much interior iron grille work.

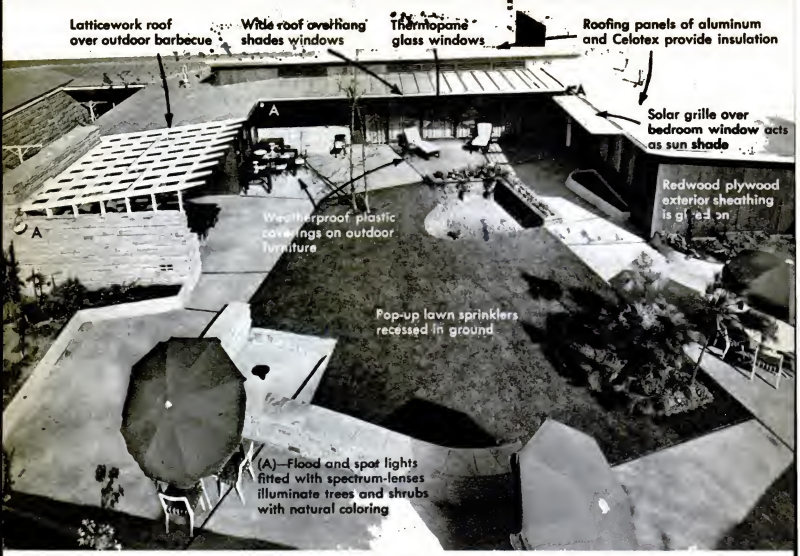
If any fad can be said to exist today it favors the one-story spreading type of dwelling, popularly called the ranch-type house. One of the most popular houses of this design is shown on this page. Modified colonial houses are also popular. Among the away-with-tradition builders—a loud-spoken minority—architects are setting out to prove the merits of the "functional modern" or contemporary house.

In regard to interior planning, wise builders are more and more concerned with laying out the house in accordance with the particular needs of their families than in following conventional lines. A popular innovation in many house plans is a hobby-workshop all-purpose room on the first floor, particularly in the home with children of high school age and under. It is a refinement of the basement rumpus room and provides facilities beyond the scope of a living room.

Regardless of the type of architecture they decide upon, prospective homeowners are alert to new materials, metals, plastics, wall coverings, dual glass for windows or entire walls, and to improvements for the kitchen, bathroom, lighting and heating.

Will you build a modern or contemporary type of house? This includes the solar house that puts the sun to work to help cut down heating bills, and the "true" modern with low horizontal lines in which every architectural feature has a special function.

National Plan Service Inc.
1315 W. Congress St.
Chicago, Ill.
V9



The $75,000 Fritz B. Burns model house contains scores of innovations in design, materials and appliances

A California builder, Fritz B. Burns, has assembled a modern showcase for the prospective builder in the form of a model research home in Los Angeles. This one-story modern is U-shaped with the main rooms grouped around a garden patio. Dual glass walls, providing insulation by dehydrated air sealed between the panes, make the attractive patio almost a part of the living room, kitchen and two of the three bedrooms. A new kind of double-paned glass in one room retards the passage of radiant heat waves from the sun.

Designed along solar principles, the Burns house has broad eaves to keep out the high-riding summer sun and admit its rays during the winter season when the sun is low in the sky. A new type of metal roofing consists of panels one foot wide and eight feet long formed by molding sheets of aluminum around insulation board. The exterior walls are plywood panels four by eight feet joined together with splines and fastened to horizontal strips mortised into the studs which do not penetrate into the outside face of the plywood.

Ceilings of the house are covered either with acoustical plaster or perforated tile, and the doors are soundproof as well as warp-proof. The bedroom walls are covered with a rubberized plastic material resembling wallpaper with designs impregnated into it. These walls are easily cleaned with a damp sponge. The "packaged" bathroom is made of enameled and highly polished wood and plastic, but later on it may be stamped out of metal. The pear-shaped tub provides a wide end for the shower which is partitioned with a revolving turret-type door of Plexiglas.

The house is completely air-conditioned and thermostats assure an even temperature. The bathroom has a full-length infrared gas heater. Dust is collected by a Westinghouse Precipitron. The house is filled with electrical appliances ranging from a vibrating electric toothbrush to a sun-tan lamp in the bathroom ceiling. A continuous electric outlet strip installed in the baseboards permits plugging in of appliances at any point. Every room has radio reception with dials offering a choice of standard radio, FM, phonograph recordings or music over telephone wires.

Innovations in lighting include a new type of flush installation which utilizes the principle of sealed-beam headlights on automobiles. The living room is illuminated with indirect fluorescent lighting, and there are neon tubes in the bookcases which can be regulated to low, medium or bright by turning a dial.

Linen closets and kitchen cabinets are lighted by continuous strips of either

The Postwar House 4940 Wilshire Blvd
Los Angeles 5, Calif.

Kitchen of Burns house has picture window and plastic walls; bedside cabinet controls all lights in house

fluorescent or neon tubes. Floodlights outside the house contain bulbs with spectrum colors in the glass which give a natural "technicolor" effect at night. These floodlights, as well as all the lights in the house and the adjoining "carport" with workshop and storage room to the rear, are controlled by a master switch in a cabinet in the master bedroom. This bedside cabinet also contains a radio receiver and an intercommunication instrument which permits talking to various parts of the house and patio.

The kitchen, a wonderland for housewives, has one wall devoted to an all-electric laundry complete with a machine that washes, rinses and damp-dries clothes, an ironer and mangle. Other kitchen features are rotating circular shelves for pots and pans, an electric sewing machine on a swinging door, a table-high console-type refrigerator, dishwasher, and garbage disposal unit which electrically disposes of waste including bones.

Frankly built to demonstrate the optimum in modern living equipment, the house and its appliances cost around $75,000. As far as the modern house is concerned, the Burns house answers the with-or-without basement problem by the simple process of elimination. The heating unit, water heater, air conditioner and Precipitron are housed in a small space on the first floor near the kitchen.

Most architects who specialize in the house of modern design say that the basement is a thing of the past. Confronted with the stubborn public reaction that "a house is not a home without a cellar," they often effect a compromise on a part-basement to house the heating unit and possibly a workshop or storeroom. In the past, it was generally conceded that a house built in a northerly climate had to have a basement to accommodate a gravity system heating plant. Now we have fans and pumps which make it possible to place the heating unit on room level. The old argument that houses without basements are damp is refuted by the best architects. Those who favor a basement for the small home say that the utility it affords cannot be duplicated for the same price above ground. The fact remains that an FHA survey in 1940 revealed that 30 percent of the houses under construction were being built without basements.

Are you among those who want a house traditional in architecture with modern improvements?

Recently, in a Chicago suburb, a house of this type built in 1939 was placed on the market for a price well over twice its original cost. It was snapped up by an eager

This two-bedroom prefab has a factory price of only $4685; roof-off view shows compact layout of house

buyer. The agent who handled the deal attributes its quick sale to two factors. One, of course, is the housing shortage with boom-era prices; the other is the fact that the house is an excellent example of what the public is looking for today. It embodies a pleasant blending of conventional design and modern improvements.

This particular house is colonial with white-painted brick walls, but effective use is made of two of modern architecture's prime contributions—the picture window and glass blocks. The kitchen, contrary to conventional design, is at the front of the house and the living room at the rear with a picture window overlooking a beautifully landscaped back yard. As in the Burns house, this small home incorporates the landscaping as an integral part of the house itself. One landscaping feature is an elevated rock garden and pool directly in line with the big window. Across an expanse of lawn the rock garden gives the effect of being held up to the viewer in the window. This raised garden also hides a more prosaic vegetable garden.

Features of the house include a terrace with outdoor fireplace backed up to the one in the living room, a wall of glass blocks in the dining room, plenty of roomy closets, air-conditioning equipment and many other modern improvements. An important consideration is its compactness and ease of maintenance. The house was built to accommodate a family of three adults and two children with the housewife doing all her own work.

The contention that this type of house—a combination of the traditional and the contemporary with the accent on a conventional exterior—is the House of Today is advanced by J. M. Wright, president of National Plan Service, and Howard J. Uebelhack, one of the firm's leading architects. This organization, which keeps an ear to the ground through lumber dealers from coast to coast, reports that 75 percent of the postwar houses building for $10,000 or less will be conservative in design.

Contrary to what the

(Continued to page 236)

Model of "featherweight" plywood prefab made in four sections, each with built-in fixtures including beds

↓ No longer being made

Plastic Toys Made at Home With Small Injection-Molding Machine

Youngsters can mold their own plastic toys at home with an electrically heated injection-molding machine. Molds are provided for cowboys, Indians, animals, train cars, club pins, buttons, buildings and even golf tees. Operation of the machine is simple. Plastic pellets are fed into the electrically heated loading chamber at the top of the molding cylinder. A hand-operated plunger forces the molten plastic into the mold located at the bottom of the machine. The plastic hardens in the mold in a faithful reproduction of the design. The machine, constructed on the same principle as the giant machines used in industry, is 12 inches high and weighs about 17 pounds. A rubber pad on the base prevents it from scratching furniture.

Midget Power Screwdriver Starts Work Automatically

About the size of a cigar, a midget pneumatic screwdriver is designed especially for driving small screws. The fully automatic tool starts work when it is applied to the screw. As the blade is pressed harder against the screw, the air power is increased and the blade is driven faster. A rotary type motor, negligible in air consumption, provides power. The chrome-finished tool has bits to handle screws ranging in size from number 1 to number 6. A socket adapts the tool for tightening nuts.

Ink Reservoir on Stencil Brush Holds Supply for 500 Prints

Enough ink to mark 500 shipping stencils is contained in a "fountain" brush with a T-shaped hollow aluminum handle that serves as the ink reservoir. The lightweight brush can be used in either a vertical or horizontal position, as the flow of ink is regulated by a valve. A button to operate the valve is located in a convenient position just below the handle.

Waterproof Plastic-Wool Hats

Wool combined with a plastic fiber produces waterproof felt hats that are said to retain their shape and size permanently. The new material looks like ordinary felt. In hat-making the plastic is "set" by heat treatment and fuses with the wool fibers.

material from: Am. Viscose Co. Eng: State Bldg. NY1, NY

The Debway Co., 350 5th Ave NY1, NY.

Your National Parks Are Ready

All roads lead to vacation lands this year. Millions of people are rediscovering good times in outdoor America

RIGHT NOW the national parks are bulging. Millions of veterans and stay-at-homes who were starved for the open spaces through the war years are jamming the 27 national parks with jalopies and trailers in the first postwar mass pilgrimage to the outdoors.

The National Park Service saw what was coming in the closing months of the 1945 vacation season. When gasoline rationing ended suddenly after V-J day Yellowstone's bears and the Kaibab deer must have noticed the surge of motorists that brought attendance in the parks to 4,000,000 for the year, a million and a half above the total for 1944. The rangers and lodge keepers began early to "clean house" for an anticipated record guest register in 1946.

From rock-bound Acadia to tropical Hawaii, the parks have everything to offer except the artificial entertainment of the city. Here the only signs of civilization are the roads and the lodges and camp grounds maintained for the convenience of the visitors. There are still lakes abundant with game fish, towering canyons of multicolored stone, deep gorges cut by swift streams. All the grandeur of nature is being conserved for future generations of Americans, and can be changed only by Nature herself.

By John L. Kent

You can fish in every park. There is exceptionally good trout fishing in Yellowstone, Yosemite and Glacier. You can camp in every park and most of them have facilities for swimming.

You can climb the skyscraping peaks of California and Colorado and the glacial mountains of Montana or descend into the earth at Carlsbad Caverns or Wind Cave or Mammoth Cave. These three parks have caverns with many miles of underground galleries and numerous chambers of stalagmites and stalactites, resulting from the action of water upon soluble minerals.

Or take a trip to Zion, Bryce Canyon or Grand Canyon. Grand Canyon is regarded as the greatest ex-

Pack burros carry camp supplies for hikers leisurely exploring the high country of Yosemite. Below left, the natural bridge at Bryce Canyon. Right, proof of good fishing below the Wyoming Tetons, a nine-pound trout

Underground fantasies like Rock of Ages at Carlsbad, above, stagger the imagination. Below, Santa Elena Canyon on the Rio Grande in the new Big Bend Park

Park Directory

All National Park areas are open to motorists whenever the roads are accessible. The following schedule shows approximate periods during which tourist facilities, including lodges, hotels and stores, are open. Park Service officials counsel visitors to make reservations well in advance or be prepared to camp.

Park	Season
Acadia, Maine	June 15 to Oct. 15
Big Bend, Texas	All year (no hotel accommodations in park area)
Bryce Canyon, Utah	May 30 to Sept. 25
Carlsbad Caverns, New Mexico	All year (overnight accommodations at Carlsbad, N. M., or other nearby cities)
Crater Lake, Oregon	June 15 to Sept 19
Glacier, Montana	May 1 to Oct. 15
Grand Canyon, Arizona	South rim, all year; north rim, May 25 to Oct. 15
Grand Teton, Wyoming	May 15 to Oct. 15
Great Smoky Mountains, North Carolina and Tennessee	All year
Hawaii National Park, Hawaii, T. H.	All year
Hot Springs, Arkansas	All year
Isle Royale, Michigan	June 18 to Sept. 21
Kings Canyon, California	All year
Lassen Volcanic, California	Summer, May 1 to Sept. 30; winter, Dec. 15 to March 31
Mammoth Cave, Kentucky	All year
Mesa Verde, Colorado	May 15 to Oct. 15
Mount McKinley, Alaska	June 10 to Sept. 1
Mount Rainier, Washington	Paradise Valley and Longmire sections open all year; other sections during summer, June 27 to Sept. 2
Olympic, Washington	April 15 to Sept. 15
Platt, Oklahoma	All year (overnight accommodations at Sulphur, Okla.)
Rocky Mountain, Colorado	All summer; limited winter accommodations at Estes Park and Grand Lake
Sequoia, California	May 25 to Sept. 9
Shenandoah, Virginia	April 4 to Nov. 2
Wind Cave, South Dakota	June 1 to Sept. 20 (overnight accommodations at Hot Springs, S. D.)
Yellowstone, Wyoming	May 31 to Oct. 15
Yosemite, California	All year
Zion Park, Utah	All year

Twenty-one million people visited parks in 1941 and enjoyed recreation like this wiener roast at Yosemite

ample of erosion and the most sublime spectacle in the world. Zion Canyon is from 1500 to 2500 feet in depth with precipitous walls of great beauty.

In Bryce Canyon, in eastern Utah, one may see spectacular results of chemical weathering or decomposition. This differs from mechanical weathering caused by the alternate freezing and thawing of water or by plants growing in openings in the rocks which by a wedging action break down the stone. Bryce Canyon was carved by the action of air and water on limestone, largely composed of the mineral calcite. When limestone weathers, a soluble compound, calcium carbonate, is produced. Water dissolves this compound and removes it in large quantities, creating the startling topography of the canyon.

To enable more of the public to see the wonders of Zion, Grand Canyon and Bryce Canyon, the Union Pacific Railroad, which operates facilities in these parks, is this year spending a half million dollars on im-

Riding party stops to watch Old Faithful, world-famous among 10,000 geysers and hot springs at Yellowstone

Giant tropical ferns flank entrance to Lava Tube at Hawaii National Park

provements on its properties and services.

Biggest and oldest national park is Yellowstone, located in northwestern Wyoming. The 3350-square-mile park is a land of geysers. The world-famous "Old Faithful" can be depended upon to stage its almost hourly show for your benefit, sending boiling water and steam 200 feet into the air. This old favorite has kept up its show despite wars, strikes and scanty audiences.

Officials of the four railroads serving Yellowstone have announced that the standard 2½-day sightseeing tour, suspended during the war, again is available during the 1946 season until September 10.

Not all the parks are in the West. There are Acadia National Park in Maine, the Great Smoky Mountains Park in Tennessee and North Carolina, and Shenandoah in the Blue Ridge Mountains of Virginia.

Shenandoah, one of the most scenic, is located only 50 miles from Washington, D. C. It is within one day's ride of about 50 million people yet most of it is still wilderness. In places only two miles wide, Shenandoah stretches along the top of the Blue Ridge for a distance of about 75 miles. It is among our most recently created parks. It was opened on Christmas Day of 1935.

The newest and 27th national park, opened in 1944, is Big Bend, a 700,000-acre park located in southern Texas where the Rio Grande, forming the boundary between the United States and Mexico, makes a big U-shaped bend in its course. It lies about 200 miles east of El Paso and 330 miles west of San Antonio. It consists primarily of semiarid plains characterized by gravel-colored slopes, arroyos and washes.

Big Bend is a new, undeveloped park for those who enjoy roughing it. Lodge accommodations are not as yet available and the Park Service warns, "Bring your own food, bedding and tents and be prepared to camp."

At Crater Lake in Oregon there is a possibility that the country may gain a new, active volcano. Crater Lake, six miles wide and nearly 2000 feet deep, is surrounded by the walls of the old crater of Mount Mazama which rise above it 500 to 2000 feet. Thousands of years ago, before the period of volcanic activity which may have caused its peak to collapse, Mount Mazama is thought to have had an altitude of some 12,000 feet. Later activity after the lake was formed created the cone known as Wizard Island which rises 780 feet above the water near the western rim.

On four separate occasions during 1945 observers saw a bluish-gray smoke or gas cloud over Crater Lake. Park Ranger Kenneth A. Hulbert said

Fertile valleys, heavily wooded Blue Ridge Mountains beautify Shenandoah

that the cloud was 300 to 400 feet wide, 400 to 500 feet high, and diamond-shaped—narrow at bottom and top, wide in the middle.

E. P. Leavitt, superintendent of the park, says that the only plausible explanation is that a blurb of smoke or gas was released from some of the vents which undoubtedly exist on the floor of the extinct or dormant crater and passed through the water to escape to the air above. The Park Service is keeping watch and may place a seismograph near the crater's rim to record any earth shocks which could be interpreted as signs of revival in Mount Mazama.

The Park Service is operating all parks on full schedule. During the war the number of employees of the service dropped from 5145 in 1941 to 1577 in 1945, but there was a compensating drop in visitors. Attendance rose in 1945 and surged sharply upward after V-J day.

Now, with many employees back from military service, the Park Service is engaged in a program of rehabilitation of roads, structures and facilities. The Park Service looks upon itself as the guardian of a great public trust whose funds of unsurpassed natural grandeur minister to the human mind and spirit.

If you want to see America, start with your national parks.

'Mathematician' for Heating Systems

Consisting of a round dial and tables printed on three concentric celluloid disks, a calculating instrument quickly supplies radiation data necessary to set up steam or hot water heating systems. Eliminating involved figuring, the "mathematician" provides such information as required sizes for mains, returns, risers, radiators, chimney flues and fuel tanks.

Radio Tubes Operate Toy Organ With "Grown-Up" Tone

Operated by ordinary radio tubes, a toy organ sounds like a full-size electronically operated instrument. The range of the toy organ is an octave and a half starting with middle C. It can be plugged into any household electrical outlet.

Adjustable Fishing Pole Holder Permits Free Use of Hands

Fishermen can keep their hands free while awaiting a strike with a pole holder that clamps to the boat or dock. The device can be adjusted to hold the pole at any angle. When the fish makes a strike at the bait, the tip end of the pole should be raised first to set the hook in the fish's mouth. Two styles of fasteners are available, a clamp for boat or dock and a screw type for pushing into the ground or screwing into logs, stumps and railings. As many as three poles can be held in each device.

Tenants Share Subzero Locker

Each tenant of an apartment building can now store perishable foods in his own refrigerated compartment. A large deep-freeze locker divided into compartments has been devised for apartment buildings.

Outside Plug Seals Boiler Leaks

Leaks in tanks, boilers and water heaters can be sealed permanently by an all-metal repair plug that is inserted from the outside with a screwdriver and pair of pliers. A soft stem of lead alloy on the plug flows into irregularities on both inside and outside walls when it is tightened. The plug is said to be unaffected by tank contents, pressure serving only to seal it tighter.

Sun Ray Dial for Architects Helps in Planning Windows

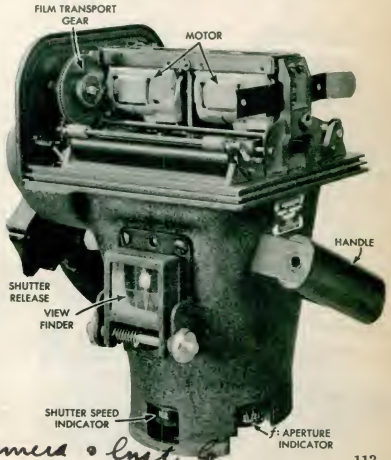
Architects, draftsmen and gardeners will find a new instrument of value in determining the direction and inclination of the sun's rays at any hour throughout the year. The "Solarmeter," as the instrument is called, is a transparent plastic dial marked with dates, mounted over a sheet of similar material that is divided into hours and degrees. When the device is oriented with the north indicator on a house or building plan, successive settings of the dial show the dates and the time of day when any wing, wall or window will receive direct sunlight. The angle at which the sun is shining also is shown so that the operator can compute how far into a room the sunlight will reach. Gardeners may find use for the device in planning their gardens. Separate instruments are available for each 2½-degree band of latitude.

Uranium Glass Wards Off Rays

Rescuers are protected from the deadly radioactive rays of exploded atomic bombs by glass manufactured from uranium, the basic element used in making the bombs. Garments made of uranium spun-glass and helmets lined with the glass permit safe entry into the bombed area, according to Prof. Alexander Silverman of the University of Pittsburgh. Oxygen respirators with uranium-glass-insulated high-frequency precipitators keep radioactive dust out of the lungs of the rescue squads.

REPEATING "Eye" OF THE NAVY

Sharp action shots are assured with the Navy-modified K-20 camera (above) and the K-25 shown below with cover removed



By Lieut. Comdr. Cecil C. Snyder, USNR

PHOTOGRAPHERS who have been longing for a fast-operating camera to record a rapid sequence of action pictures may find it in the K-20 and K-25 aircraft cameras adapted by the Navy for ground use. Both have been combat-tested and will produce a series of 4x5 negatives with excellent detail. Each exposure consumes only a fraction of a second.

Photographer's mates, early in the war, began using the Fairchild K-20 for other than aerial assignments. The fast operation of the camera made it highly adaptable for photographing flight deck activities aboard carriers. Its only drawback for ground work was that it could not be focused. Since it was manufactured for aerial use the lens was permanently mounted in the infinity position.

The standard f:4.5 lens for the K-20 has a 6⅜-inch focal length. With the lens wide open at infinity

Fairchild Camera & Inst. Co.
88-06 Van Wyck Blvd.
Jamaica, L. I. N. Y.

any object within 188 feet will not be sharp. Stopped down to f:11 the hyperfocal distance is 77 feet. Thus the fixed infinity focus of the lens gave the camera a limited application in ground photography.

Realizing that the K-20 would be far more valuable for general use if a focusing arrangement could be devised, Earl J. Hackethorn, PhoM. 1/c, stationed aboard an escort carrier on antisubmarine patrol in the Atlantic, went to work on an idea. With only the tools and material available aboard ship, Hackethorn designed and built a focusing attachment which was accepted by the Navy. Aeroflex Laboratories, Long Island, N. Y., was awarded the contract for production.

The K-20 is simple to operate, rugged and easy to handle. The lens and shutter assembly is set in a cone, to the back of which is attached a roll-film magazine. A hand grip is fastened to the left of the cone and a trigger release handle on the right. Through a series of gears and wind and trip rods, the film is advanced and the shutter set by merely pushing the trigger handle forward 50 degrees and bringing it back into position. The winding operation is carried out on both movements.

In other words, a simple wrist movement which does not necessitate moving the camera advances the film and sets the shutter. Within a split second the cameraman is ready for his next exposure. The elapsed time between shots depends upon the proficiency of the photographer.

The task of modifying the camera to allow focusing was not particularly difficult. A means had to be devised for moving the lens forward for close-up work. This was accomplished by mounting a threaded ring permanently on the nose flanges of the camera. A second ring, also threaded, was fastened to the lens and shutter assembly which, when screwed into the permanently mounted outer ring, racks the lens in and out of the cone.

One other engineering problem was encountered. The wind and trip rods for the shutter, operating from the gear mechanism in the magazine, had to be made adjustable to lengthen or shorten as the lens assembly is moved. The redesigned rods are made from two pieces of metal, one fitting inside the other. A spring, inserted in the open section, brings the rod to the proper length as the lens is focused. With this modification, the K-20 can be focused at any point from 15 feet to infinity.

Taken by an electrically operated K-25 camera, sequence of action pictures shows a Navy Helldiver crash-landing on carrier; the engine breaks off, plane catches fire, pilot and gunner are rescued and fire fighters go into action all within a few seconds

As the war progressed, a need developed for an electrically operated aircraft camera, to be remotely controlled by the pilot, for photographing attacks on enemy submarines and shipping. It was necessary that the camera have rapid rewind and fast shutter action as most of the attacks were high-speed runs at low level.

The aerial camera most suitable was the K-20 with shutter speeds of 1/125, 1/250 and 1/500 second. A small motor was installed within the magazine to operate directly on the gears of the camera. The first cameras produced, known as K-25s, provided 2.5 exposures every second, which was varied slightly in some of the later models. Both Fairchild and Graflex were given production contracts.

Here, again, photographer's mates saw the advantages of this camera for ground use, especially in rapid combat action. Experiments were carried out to install a trigger handle like that of the K-20, for hand-held use. The focusing attachment developed for the K-20 also fits the K-25.

Before the war most fast action sequences were made with 35-mm. single-frame or motion picture cameras where it is difficult to maintain detail in enlargements of sufficient size for good reproduction. Now, with the focusing models of the K-20 and K-25 cameras, sequence photographs of football, baseball, track and field competition and other sports are possible.

Film for these cameras comes in 19½-foot rolls giving 50 exposures without reloading. The camera can also be reloaded in subdued light.

Eastman Kodak Company supplies two panchromatic emulsions, Super XX and Tri-X, for use with the K-20 and K-25 cameras. Aero Kodacolor is also available and may be utilized for ground photography, offering the possibility of fast color shots.

It is unnecessary to expose the entire roll of film before developing the negatives. The magazine may be opened in the darkroom and the exposed length of film cut from the feed roll. The balance is reloaded in the camera. Development may be carried out by tray or roll-film tank method.

It is an easy matter to install a 110-volt motor in place of the 24-volt system used for aircraft operations so the camera may be plugged into any standard electrical outlet. It also is possible to synchronize the camera with a high-frequency flash unit, as was demonstrated by the Navy.

Although both the K-20 and K-25 are constructed entirely of metal they are not excessively heavy, each weighing approximately 11 pounds fully loaded. They measure 12 inches long, 8½ inches wide and 7 inches thick. Both are equipped with a Newtonian optical oblique viewfinder.

Electric Printing Machine Types Lettering Onto Large Drawings

Typists instead of highly paid engineers and draftsmen can letter large drawings, plans and charts with an electric lettering machine that is operated like a typewriter. The drawing is placed over a large flat platen that permits an unobstructed view of 396 square inches of surface, enabling the operator to type letters with pinpoint accuracy within the area. The keys can be adjusted to produce lettering of any desired density. A special "blueprint" ribbon is used. There are no feed rollers on the machine to smear or mar the drawing. The device does the lettering at typewriter speed with mechanical neatness and accuracy.

Flame Gun Burns Weeds Or Thaws Frozen Pipes

Weeds and brush can be destroyed easily with a peacetime "flame thrower" that shoots a flat flame of 2000 degrees Fahrenheit. The gun consists of a four-gallon steel tank with an air pump, an oil-resistant hose and a nozzle device that controls the flat flame. It burns kerosene, range oil or light furnace oil at an average rate of one gallon each hour. Proposed uses include destroying green weeds, backfiring safety strips to restrict forest fires, disinfecting poultry houses and thawing frozen pipes.

Floor Outlet for Automobile Exhaust Protects Garage Workers

Carbon monoxide gas that endangers the health of garage and filling station employees is piped out of buildings by a floor outlet for exhaust systems. The gas emerging from automobile exhaust pipes is drawn through an eight-foot flexible hose into the floor outlet and then blown out of the building. A double socket for installation between stalls permits two cars to be serviced by the same outlet. The hose is attached to the car's exhaust pipe with a snap-type opening in which attachments may be inserted for analysis of an automobile's exhaust gas.

WIN MAC DONALD
208 N. OHENY DR
BEVERLY HILLS
CALIF.

Rough Riders on Water Skis

FOR plain and fancy thrills on the water there's nothing that can compare with water skiing behind a speedboat.

At 40 miles an hour the sensation of speed is terrific. You swoop out to one side at the end of the tow line, boosting your speed 10 miles above that of the boat. Crossing back behind the boat to the other side, you jump the boat's wake instead of smashing through it, straightening up just as you hit the uplift of the wake. The impetus sends you 10 or 15 feet through the air, six feet above the water.

You do all this while standing on two varnished slabs of wood, six inches wide and half a dozen feet long. When you become proficient, you'll do a lot of skiing on one ski, leaving the other ski in the boat.

Water skiing is exciting but safe, an easy-to-learn

In these three pictures Bruce Parker of Miami demonstrates the difficult feat of changing tow lines from a speed launch to an airplane while he cuts through the water at 70 miles an hour

Ideal boat for towing water skiers on quiet lakes is this pontoon rig made of automobile gasoline tanks

sport. The average beginner gets the hang of it and can stand up for a ride of several minutes after only four or five starts. Later, when he learns to relax and his muscles acquire strength he can ski for much longer periods. Win MacDonald of Hollywood, one of the world's finest water skiers, once spent seven hours on one ski while being towed round trip from San Pedro to Catalina Island, nonstop.

One of MacDonald's stunts is to fish as he skis up the faces of deep-water ocean breakers. Carrying a harpoon, he looks for sharks or swordfish that may be basking on the surface. His approach is practically noiseless, out to one side of the speedboat, and he slides right up alongside the fish, aiming the harpoon. The harpoon is attached by means of a light line to a buoy that is carried in the speedboat. The buoy is tossed overboard when a fish is speared. The ski fisherman is picked up by the boat, the floating buoy is retrieved and the fish is hauled in.

MacDonald advises a beginner to start on an aquaplane, a broad board surface, until he gains balance and confidence. Then he may graduate to skis. The correct ski posture is a crouch similar to the crouch used in snow skiing. Bent knees absorb the shocks caused by small waves.

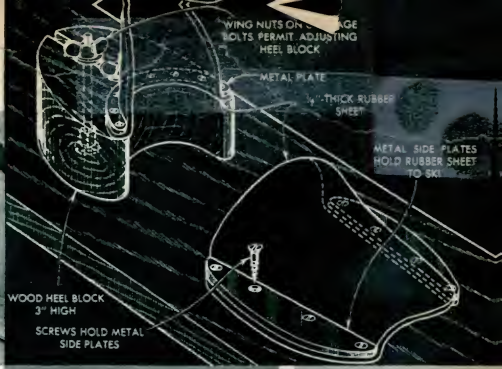
You may start out from deep water or, wearing one ski, you may make a flying start from the beach. In a deep-water start you put on your skis, bring your legs up under you and signal the speedboat to move ahead. Holding the tow line, you are dragged up through the water until your skis are riding on the surface. From your squatting position you can then rise to a well-balanced crouch.

For an experienced skier a flying start on one ski is a faster way to get going. He stands on one leg in water that is half way to his knee, his other foot and the ski resting on the surface. At the instant the tow line becomes taut he makes a one-legged jump from the bottom. He's off in a swirl of spray, riding one ski.

The easiest way for the skier to stop is to signal the speedboat to slow down, then release the tow line after he starts to sink. He can also pull himself up the tow line to the boat and climb aboard. Experts ski right into the shallows and step ashore practically dry. The boat pulls a proficient

No ghost pilots the boat that is pulling this skier. He's rigged up remote controls operated by his tow line!

Right, adjustable bindings are made of wood and rubber. Below, keels fastened to bottom improve stability



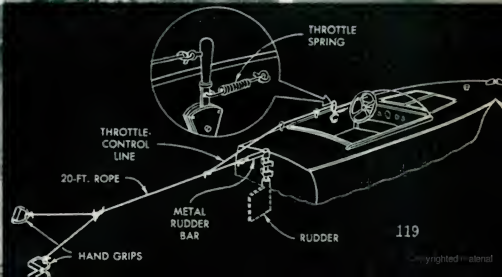
skier close to shore at full speed. When the skier lets go of the tow line, his momentum carries him in 100 feet or more. As he reaches shallow water he digs in with his heel, braking to a perfect stop.

Water skiing apparently started on the French Riviera about 15 years ago after water sport enthusiasts decided ordinary aquaplaning was too tame. The first skis were a foot wide and nine feet long.

About 10 years ago smaller skis were tried out at Lake Arrowhead, California, and other parts of the United States. Some experts whittled their skis down until they were doing stunts on "splinters" only three feet long and four inches wide. Skis like these are skittish and hard to control except at high speeds.

Oddly enough, it's almost impossible to get hurt in a spill. Your feet slip out of the

Right, experts demonstrate spectacular stunts at high speeds. Diagram shows how boat was rigged for remote control



Copyrighted material

bindings and you slide across the water to a gradual stop. Southern California and Florida have thousands of ski enthusiasts and the sport has spread to many large lakes and rivers. Ocean skiing usually requires the most skill. The test of an accomplished skier is his ability to hang on in rough ocean water.

Skis six feet long and six inches wide are about right for people of average weight. These will support you at 20 miles an hour and are perfectly maneuverable at 40 miles an hour and up. The most pleasant skiing speeds are from 30 to 35 miles an hour but the more proficient you become the faster you usually want to go.

Because most skiers build their own skis there is considerable latitude in design. A pair of flat boards, six feet by six inches and ¾ inch thick, of vertical grain spruce, mahogany or ash is the usual raw material. One end of each board is tapered, rounded and bent upward to form the toe. The bending may be done by steam or by immersing the end of the board in boiling water for 20 minutes, then placing it in a form that provides an upward bend of four inches on a one-foot radius. Width of the after end of the ski may be reduced by tapering each side ¼ inch. This will allow the toe to ride higher in the water.

The binding in which you place your foot may consist simply of an old shoe with the laces removed. It is attached to the ski with half a dozen screws around the edges of the sole plus a longer screw through the heel. The binding is located about midway on the ski. It should balance at the point where the ball of your foot will rest.

Instead of using old shoes, most skiers prefer bindings that can be adjusted to fit different sizes of feet. A sheet of ¼-inch-thick live rubber is cupped upward so it fits snugly over the front part of the foot. It is fastened by metal plates that are screwed tightly to the ski. The wooden heel block, rounded and padded with live rubber, is adjustable. It contains a slot through which two carriage bolts project that are anchored to the bottom of the ski. Wing nuts clamp the heel block in place.

Some skiers attach an "island" board two feet long to the center of each ski and fasten their bindings to the board. Others taper the bottoms to give a slight V effect but this seems to have no effect on performance in the water. A two-inch wooden keel, screwed to the after end of the ski, contributes to stability and control, especially if the ski is of short length.

Bruce Parker of Miami recently traveled 70 miles an hour on water skis by hooking a ride behind a seaplane. He started out behind a speedboat. When the boat was traveling at peak speed he grabbed a tow line that was dropped from the seaplane as it roared past. He hung on while the plane built up its speed. At 70 miles an hour his skis were practically out of water.

Win MacDonald, similarly, set a water ski record of 81 miles an hour several years ago while being towed behind a seaplane. At high speed the spray beat against his legs like gravel and the terrific rush of air almost blinded him. But that experience wasn't as bad as an earlier one. He was being towed by a blimp for a motion pic-

(Continued to page 224)

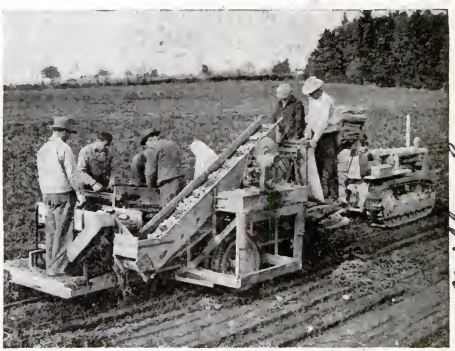
Left, 6-year-old learns to ski by practicing on aquaplane. Right, Florida beauties zip through boat's wake

Armor Plated "Battle Sleds" Towed to Position by Tanks

U. S. Signal Corps photos

Another battle-born gadget recently revealed by the War Department is the "battle sled," used to protect infantrymen while they were transported to advance positions to knock out enemy guns. The nine-foot sleds were made of ⅛-inch armor plate and mounted on ¼-inch steel runners. Twelve of them, attached in pairs, were pulled snakelike behind a tank, which protected them against mines. The group of sleds was flexible enough to turn with the tank. One infantryman with his equipment was carried on each sled. The sleds were designed by Brigadier General John W. O'Daniel of the 3rd Division, and were used by that unit in Italy in 1944.

Combine for Harvesting Potatoes Digs, Sacks and Loads



In one continuous operation, a potato combine devised by an Oregon farmer digs, sacks and loads. Manned by a nine-man crew, including the driver of the truck which carries the sacked potatoes from field to market, the combine will harvest and process 1226 sacks of potatoes per day—enough to feed 1000 persons for one year. The combine, powered by a Caterpillar Diesel tractor, is in operation on Robert H. Miller's 600-acre farm near Gresham, Ore. It digs the potatoes from the ground and lifts them to a sorting rack where they are brushed, graded and processed by crewmen. They are then placed on a conveyor which lifts them to sackers who move the loaded sacks to trucks traveling along in the field at the side of the combine.

Designed by: Miller Bros. Route 2 Gresham, Oregon

Solution Renews Sandpaper By Removing Wood Dust

Used sandpaper that is filled with wood dust, paint or varnish can be restored to life with a solution that is brushed onto the paper. The solution is allowed to impregnate the abrasive for about five minutes. Then the paper is rubbed with a fine steel brush to remove all particles that clogged the cutting surface. The solution can be used also on cloth sanding belts, buffing wheels and disks and files. It is said to be nontoxic, nonirritating to the skin and will not corrode metal machine parts.

¶Three 5400-horsepower Diesel-electric freight locomotives have hauled Baltimore & Ohio trains over 850,000 miles in two years without a breakdown or a missed trip.

Nelson putting in the Masters', which he's twice won

The Mechanics of GOLF

Part 3

By Byron Nelson

For your third lesson, study the short irons, chipping and putting —then play two holes with Nelson

YOUR primary concern in playing a short iron (Nos. 7, 8, 9) shot is accuracy. Thus, complete control of the club and a fine "touch" are of supreme importance.

I shorten the grip on my club when playing a shot with a short iron, placing the little finger of my left hand about 1½ inches below the top of the shaft. In this way I get better "feel" of the clubhead, and this is an aid to accuracy.

Too many people have a tendency to let foolish pride get the better of their good judgment in playing shots with short irons. When I hear someone say, "I always use a No. 9 iron for a 125-yard shot to the green," I know that person has the wrong idea. Ability to hit a ball beyond the normal hitting range of any one club is not a criterion of a good golfer. It's just plain nonsense.

Successful tournament players have none of this false pride. They use a club with which they can take a normal, smooth stroke and get the ball to the objective. In the case of the short irons, this objective is usually the cup on the green. For the average golfer I recommend a No. 7 or 8 iron for a shot of approximately 120 yards. It is a shot of this length I am playing in photos 1 through 8 on page 123.

What difference does it make if you can boast that you hit a No. 9 iron, for instance, a few yards farther than someone else? The point with the short irons is to get the ball right up close to the hole, or in it.

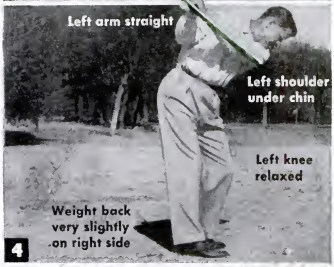
A common impression is that you need not follow through with the short irons. As you see in photo 8, this is not the case.

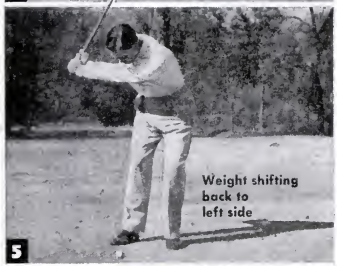
No. 8 IRON

Head directly over ball
Hands close to body
Open stance
1

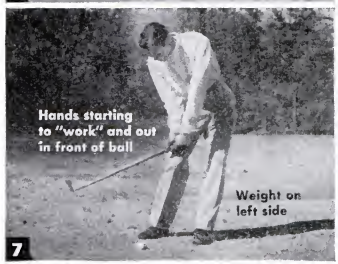
Clubhead starts back in upright arc
2

Left shoulder turning under chin
3


Left arm straight
Left shoulder under chin
Left knee relaxed
Weight back very slightly on right side
4

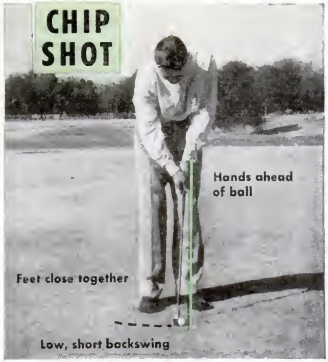

Weight shifting back to left side
5

Wrists haven't started to uncock
6


Hands starting to "work" and out in front of ball
Weight on left side
7

Hands above head at finish of backswing. Club held firmly
8

Champ's eyes follow ball he just blasted from trap



The author prefers a four or five iron for this shot

The principal differences to be observed between the way you play a short and a medium iron are, for the short irons, (1) feet closer together, (2) hands closer to body, (3) bent over a little more at the waist because of shorter shaft, (4) standing nearer to ball, (5) more upright arc to swing, (6) more hand and arm motion.

Photos 1 through 8, plus accompanying explanatory matter, illustrate clearly the mechanical details of the swing for a shot to a green approximately 120 yards distant.

If you have ambitions to be a low-score golfer, remember that skillful use of Nos. 7, 8 and 9 irons is of great importance.

As I mentioned earlier in this series of articles, many golfers who can hit a ball tremendous distances with woods and long irons may never be winners for the principal reason that they cannot hit short irons accurately. It is finesse in the use of these clubs that really pays off.

To make my point more clear, almost any day on any golf course you may observe two men of apparently comparable abilities with woods and long irons, yet one may come in with a 75, while the other has an 85. Chances are that the player with the 75 hit his short irons up closely enough for two putts at the most on some greens and for a single putt on others. The 85 player probably missed the green altogether more often than he hit it with a full 7 or 8 iron shot. Most courses are built so that a poorly aimed shot at the green winds up in a trap, bunker or in long grass.

I usually shoot my lowest rounds on the days I am hitting my medium and short irons up frequently to where I can get into the cup in one putt.

The short irons are great scoring equalizers. One day I witnessed a golf match between a powerfully built former All-American football player and a short, slightly built young chap.

The big fellow was booming his drives out 20 and 30 yards beyond his pint-sized opponent. But, while the big one was getting into all kinds of trouble with his short irons, the small one was "knocking 'em stiff" with his medium and short irons. It was no contest. The long-hitting "Goliath" was completely mastered by accurate-shooting "David."

CHIP SHOTS

The short chip shot from within a few yards of the edge of the green is another invaluable asset in cutting down your scoring total.

The photo above illustrates the stance for such a shot. You needn't grip the club as firmly as for full iron shots.

I will take the clubhead back away from the ball fairly close to the turf and on a straight line running from the objective back through the ball. The clubhead will follow through on the same line. This stroke puts overspin on the ball and tends to hold it on the intended line of flight.

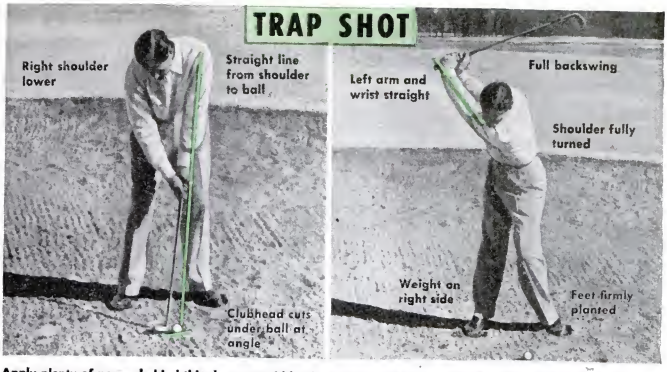
I prefer a No. 4 or 5 iron for this shot.

SAND TRAP SHOTS

Most golfers go down into a sand trap with their No. 9 iron or double-duty niblick as though they were doomed, and quake in their shoes as they prepare to try to play the ball out of the heavy sand.

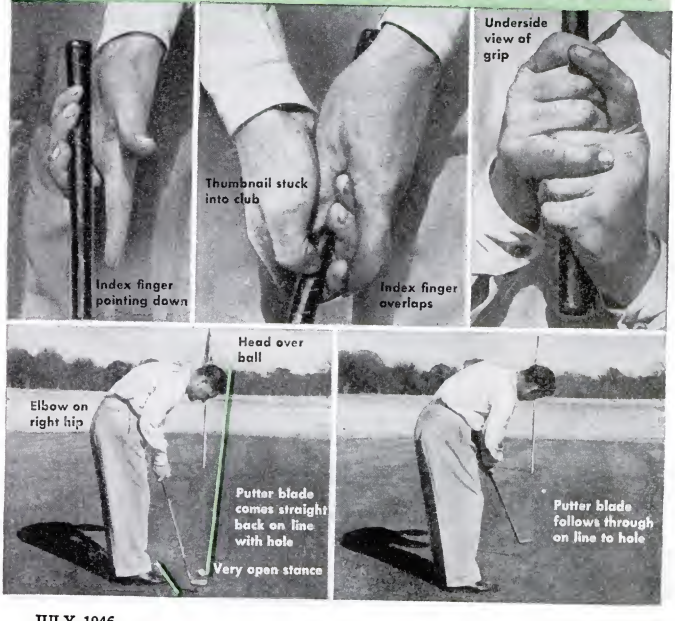
It's really not as bad as that. In fact, there is a wide allowance for error in blast-

TRAP SHOT



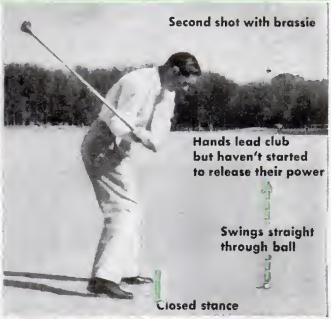
Apply plenty of power behind this shot to avoid having your clubhead stop in the sand, Golf's No. 1 star urges

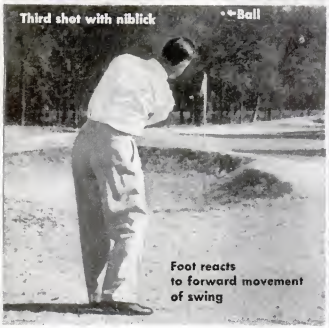
GRIP, STANCE AND STROKE FOR PUTTING

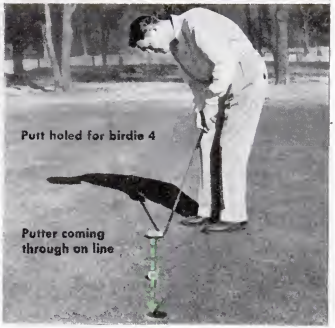


"Lord Byron" driving in a professional tournament at Miami. McSpaden and Byrd, left foreground, await turns

NELSON SHOOTS A BIRDIE ON HOLE No. 1







ing the ball out of a sand trap. Your clubhead may cut down into the sand anywhere from a half inch to three inches behind the ball; if you swing all the way through in a full stroke, chances are the ball will carry out of the trap.

To get set take an open stance with your feet, and work them down into the sand so that you have a firm foundation.

In starting the clubhead back for this shot you take it up in an arc outside the imaginary line of flight (in other words, away from your body). This is to enable you to swing the clubhead through under the ball at an angle cutting across the ball from outside the line of flight to inside the line of flight. This stroke gets the ball well up in the air and puts so much spin on it that it stops practically where it lights.

The ball is played from opposite a point just a little in from the left heel.

For any ordinary shot, I try to cut the clubhead down into the sand about two inches behind the ball, and not more than two inches deep at the bottom of the swing. The distance the ball will travel is determined by the amount of sand between the spot at which the clubhead enters and the ball. The less sand, the longer the flight of the ball. I never try to hit any closer than a half inch.

The clubhead is laid back nearly flat, as the first trap shot photo on page 125 illustrates. As you can see in the next photo, I take a full backswing for this shot. You must apply enough power to make sure your clubhead does not stop in the sand.

PUTTING

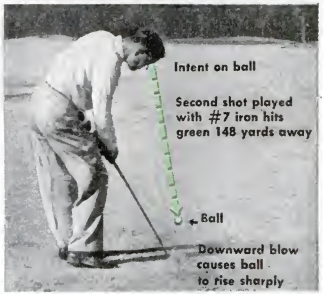
My putting grip is the result of a great deal of experimentation aimed at incorporating into it (1) a maximum of coordination between hands, (2) feel. I wanted my hands to work together as a single unit.

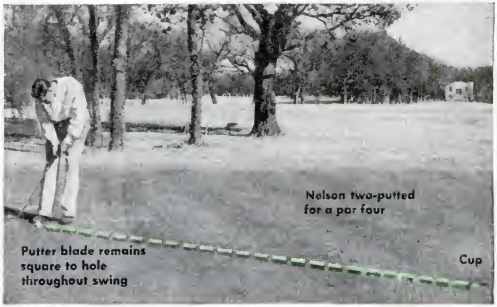
The comment has often been made, "If Nelson could only putt..."

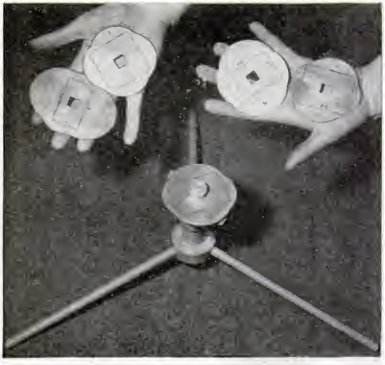
As a matter of fact, I consider this one of the stronger features of my game. I have had a comforting number of putts of from six to 30 feet roll into the cup at times when the pressure was really on. Like any other human, I miss an occasional four or five-footer, but not enough to cause me special concern.

(Continued to page 228)

PAR FOUR ON No. 2





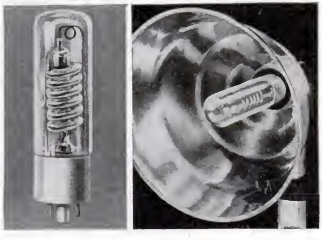


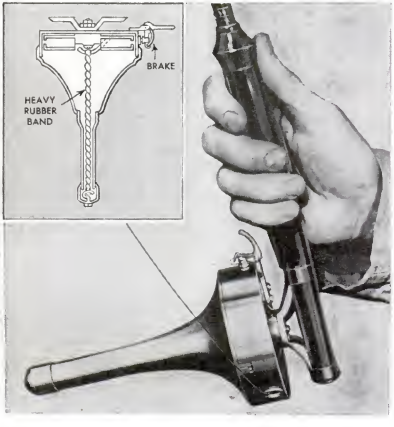
Adjustable Lawn Sprayer Sprinkles Square Plots

Sprinkling the entire surface of a square or rectangular lawn without spraying adjoining sidewalks is the fascinating feat performed by a new lawn sprinkler. Five disks control the shape of the spray from a long narrow rectangle to a square. The maximum area the device will spray depends upon the water pressure. The sprinkler will cover a 32-foot square under the average water pressure of 35 pounds. Reducing the pressure by closing the faucet restricts the size of the area that will be sprayed. The sprinkler distributes the water evenly without soaking particular areas with too much water.

Repeater Flash Bulb for Photogs

Several thousand individual flashes of daylight photographic illumination are provided by one repeating photoflash bulb. The bulb is 50 times faster than an ordinary flash bulb. Color tests indicate its light is the same as normal daylight so no filters are required for indoor use with daylight-type color film. The bulb has a porcelain three-prong base. Inside the bulb is a gas-filled coiled glass tubing. Power discharged through this coil provides the illumination.





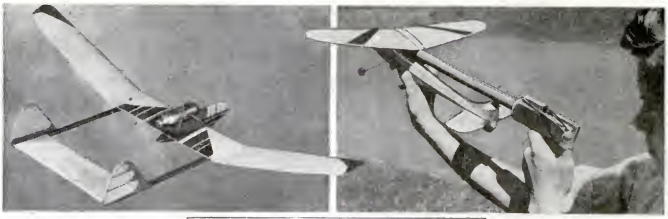
Noiseless Fishing Reel Powered by Rubber

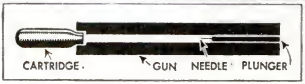
Noiseless automatic fishing reels employ a block or band of rubber to retrieve the line. As the line is payed out, the rubber is twisted tightly. When the reel brake is released, the rubber untwists, reeling in the line without jerking. The new type reel is said to eliminate cleaning and repair problems encountered with the conventional reel.

¶Many of the products described in this issue are available or are ready to be marketed. Popular Mechanics is prepared to give you additional information on these products, including the name and address of the manufacturer or distributor. Simply write to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Illinois.

aircraft Prod. Co. West Chester, Pa.

Dual-Propelled Model Plane Uses Jet and Rubber Band





Dual propulsion—rubber bands plus jet action supplied by carbon dioxide cartridges—is the latest development in model planes. With the cartridge attached to the plane, a wooden launching gun equipped with a strong rubber band and a needle-pointed plunger sends the miniature aircraft zooming into the air. The rubber band releases the plunger which breaks a small hole in the cartridge to expel the carbon dioxide gas and provide the jet power. Planes with propellers have the added power supplied by "wound-up" props. The person launching a dual-propelled ship winds the prop, positions the plane on the cartridge-holding launching gun and releases the trigger and prop at the same time. Designed by engineers of Aircraft Products Company at West Chester, Pa., the planes are available in various models, including a miniature replica of the Ryan Fireball. Scientific principles of flight, weight and air control were followed. For example, the weight change that occurs due to carbon dioxide discharge does not unbalance the plane since the cartridge is prepositioned to maintain its proper center of gravity. The carbon dioxide cartridge—the same type used in siphon bottles—is powerful enough to give a plane a fast lift but is not dangerous to use, the manufacturer explains, and contains no fire or explosives. Carbon dioxide was decided on after experiments showed powder was difficult to handle and sometimes dangerous.

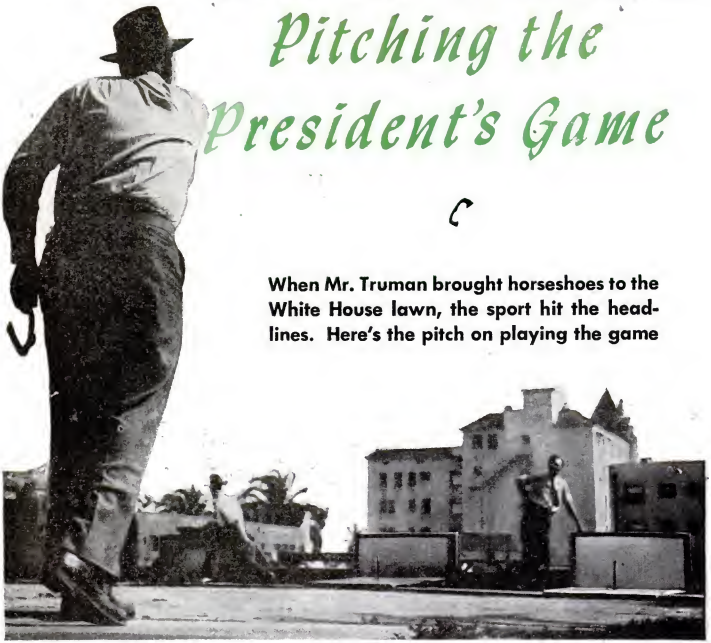
Molded Chairs Mounted on Rubber Cannot Be Tipped

Shock-mounted chairs which are molded to fit the contours of the body, and which have a rear leg to defy the most relaxed sitter to fall over backward, soon will be on the market. Shock-mounting of this molded plywood furniture is achieved by joining the seats and backs to the frames with live rubber disks which are bonded to wood surfaces by high-frequency heating. Natural finish, upholstered and stained models are offered, the stain applied by a new process said to soak the color deep into the plies without blurring the natural surface and markings. Companion pieces for living room, dining room and outdoor use also have been designed by Charles Eames, who showed them at New York's Museum of Modern Art. It is planned to produce the pieces this year.

Evans Products Co.
15310 Fullerton Ave.
Detroit, Mich.

Pitching the President's Game

When Mr. Truman brought horseshoes to the White House lawn, the sport hit the headlines. Here's the pitch on playing the game



BY RICHARD W. EMERY **PHOTOGRAPHS BY ED LUNDBERG**

IF someone tells you horseshoe pitching is a farmer's game, don't believe it! It's a soldier's game. Farmers learned the game from soldiers when the soldiers came home from the wars—back in ancient Greece, a couple of thousand years ago!

When President Truman recently established a horseshoe court on the White House grounds, he pitched a dead ringer for a game that has between two and three million followers in the United States. Now the sport is in the national spotlight. And many a foresighted statesman is brushing up on horseshoe pitching, just in case!

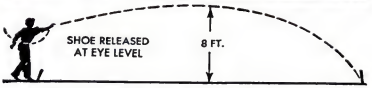
No, horseshoe pitching is not a farmer's game. It's been popular with farmers since grandpa was a kid. But the game cuts across the lines of income, social position and occupation to carve a homely niche among America's popular pastimes. The clank of steel against steel can be heard from tenement districts to millionaire estates. The game is especially popular with factory workers, who flip horseshoes between bites of their noonday lunch. And where's the village firehouse that has no pitching court just around the corner from the hooks and ladders?

Chief reason for the popularity of the sport is the simplicity of the equipment and the small area needed for a court. Secure a couple of steel pegs in properly prepared beds, buy a few horseshoes and you have a court. One set of shoes will last a lifetime. It's inexpensive entertainment that pays a bonus in muscle building. It's easy-moving sport that's played in outdoor air.

There are ways and more ways to pitch a horseshoe. The experts have their own styles. But the game itself is standardized under rules adopted by the National Horseshoe Pitchers Association of America. The game has its local, regional, state, interstate, national and world championship

National Horseshoe Pitching Assn.
213 S. Everett Ave
Monterey Park ~~Long Beach~~
Calif.

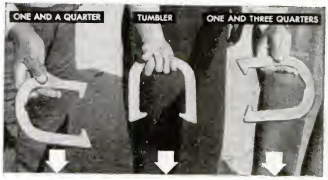
National Champion Isais keeps his arm straight at the peak of the backswing, shoe held high above his head, weight on right foot

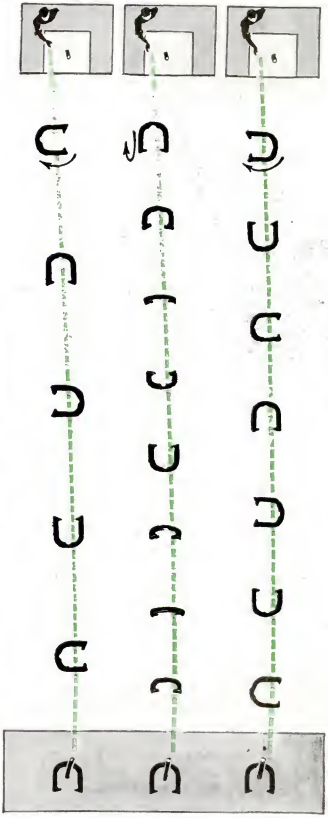


This trajectory of the champion's pitch shows that the shoe travels fairly low to the ground. It is still moving forward when it lands at base of stake

In a good toss, the horseshoe "opens" straight into the stake, then locks itself there on the rebound

Each player has a favorite method of holding shoe. Here are three of the most popular grips. Note the number of turns each shoe makes as it rotates in flight





Note the champion's finger position as he aims at the opposite stake. The little finger gives positive control to the shoe's rate of rotation

Shoe remains on a vertical plane until it clears the leg. Then it is turned horizontally and given a clockwise twist as it leaves the hand at eye level

tournaments. And champions of the sport are real athletes.

How does a champion pitch a horseshoe? Take a look at Fernando Isais in action. He's a husky 32-year-old Californian who was born in the fishing village of La Paz, in Baja California, Mexico. He's of Spanish Basque descent, and that last name is pronounced "ee-sah-ees" with the accent on the middle syllable.

He's a horseshoe champion extraordinary, but he's never ridden a horse and he's never lived on a farm. He's been winning horseshoe pitching championships for 15 years. He was the champion tennis player in the Mexican Southern California tournament for 1946, and he averages a husky 186 as a bowler in league play. Between tournaments he manufactures Venetian blinds at Ventura, Calif.

Soon after Isais started pitching horseshoes he won the California championship. That was in 1931. He has held the state title eight or nine times and has been interstate champion of Arizona, Indiana, Utah, Iowa and Oregon. In 1934 and 1935 he toured the country with Ted Allen, national title holder at that time, giving exhibitions of plain and fancy "hoss shoe" pitching. He whipped Allen at the Iowa State Fair at Des Moines in 1941 to win the national championship and he has held the title through the war years.

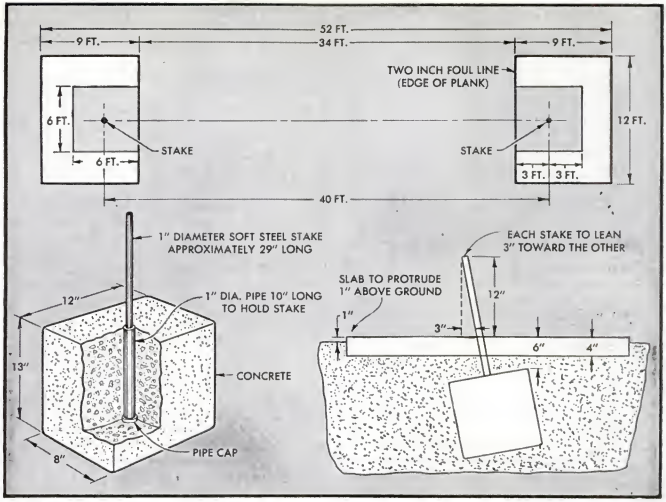
Championship pitching is not a lazy everyday sport. It's a gruelling game that calls for great physical endurance and steady nerves. Many a contender drops out because of fatigue. Isais trains for a tournament by putting himself in top condition with four hours of practice a day for at least six weeks before the tournament. "It's like any other sport," he says. "Practice counts!"

Isias started out as a "1¼" pitcher. That is, he first pitched a horseshoe that turned one and one fourth revolutions in mid-air.

"But I found I could do better with a shoe that turns faster," he says. "Now I throw a one and three quarter shoe. It grabs the peg better. It doesn't bounce back as easily."

In action, Isais has the precision and grace of motion that mark a fine athlete. And if you want to learn his style of pitching, here's the way to toss the shoe:

With your left hand, hold the shoe with caulks down, open end toward your right. Grip the shoe with your right hand, thumb on top with three fingers reaching under



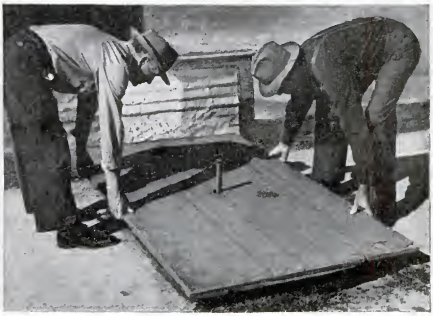
Drawing from National Horseshoe Pitchers Association of America
Here are dimensions for building your own horseshoe court. The equipment and materials are inexpensive

the shoe and gripping its inner edge. Brace your little finger against the toe caulk—that's the one on the round end of the shoe.

"Bracing your little finger like that will always give you exactly the same hold on the shoe," Isais says. "The whole purpose of your grip, your stance and your delivery is to standardize your movements so that every pitch will be exactly alike. Then you should work to improve your accuracy."

Stand in the pitcher's box, about even with the stake, feet close together, with your weight mostly on your right leg. Raise the shoe to "sighting" or "aiming" position, at full arm's length ahead of you. Swing the shoe back and drive your arm high up behind you, keeping elbow and wrist straight.

Left, clay that is too dry should be sprinkled thoroughly and covered with wet burlap. Right, when court is not in use it should be sheltered by a wooden or metal cover to keep the clay at puttylike consistency



HOW THE SHOES EARN POINTS

↑ Tie scores, such as these ringers by opposing players, are not counted. But "close" shoe wins a point

↑ Here only the single ringer counts. All the other horseshoes are more than six inches from the stake

↓ The shoe at the left is a "leaner." It has no more point value than a shoe that barely touches the stake

When Isais makes this backswing, he leans sharply forward from the hips. His hand and the horseshoe are high above his head.

In this position, you are ready to start the forward swing, which will send the 2½-pound steel shoe sailing 40 feet to ring the opposite stake—you hope.

Bring the shoe downward and forward without turning it off a vertical plane, until the shoe has passed your right leg. If the shoe bumps your leg, your pitch can't be accurate. Keep your eyes on the opposite stake.

On the upswing, turn the shoe to a horizontal plane and give it a slight clockwise twist. Let go when the shoe is on a line between your eyes and the opposite stake.

If you're going to practice the game you'll need a court of your own. The court should be laid out in a north-south direction so pitchers at either end won't be facing the sun. The stakes are 40 feet apart, centered in six-foot square pits topped with six inches of puttylike clay. A pitcher's box three feet wide lies on each side of the pit. The foul line is the edge of a two-inch plank set into the ground across the pitcher's box three feet in front of the stake.

To prevent the hard-hitting shoes from loosening the stake, set the stake firmly in a block of wood and bury the block 18 inches deep. The stake, of one-inch-diameter steel, should project about 12 inches above ground level. Each stake inclines three inches toward the opposite stake.

The shoes aren't real horseshoes—the kind that horses wear. They're made especially for pitching and they come in standard shape, weight and tempers. Isais likes a "dead soft" temper shoe for tournaments, because it has less bounce. A soft shoe soon gets full of dents, however, and if you use one you'll need a file to remove sharp edges.

Standard shoes must not exceed 7½ inches in length, 7 inches in width or 2½ pounds in weight. The opening between the heel caulks—the open end of the U—cannot exceed 3½ inches.

For purposes of scoring a game is divided into innings. When each contestant has pitched two shoes, that's one inning. A tournament game is played for 50 points, but league games usually are played for 21. A regulation contest between two players consists of the best six out of eleven games.

To earn any points the shoe must lie within six inches of the stake after all four shoes have been pitched. The closest shoe within six inches of the stake scores one point. A ringer scores three points. All equal scores by opponents in any one inning are ties and are not tallied. In each inning, a player may gain in score only by superior pitching. Tournament games have gone to 130 shoes per player before one player could win 50 points.

"That's when training counts," says Fernando Isais. "Training gives you confidence. When the game gets tough, you don't lose your nerve. The crowd doesn't upset you. You are sure of your delivery. And with luck—you win!"

"Swords Into Plowshares"—Australian Version

Australian inventors, who submitted more than 20,000 ideas to aid the Allied war effort, are working now to convert military equipment to peacetime use.

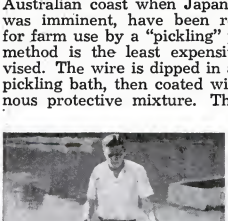
Thousands of ideas for utilizing enormous quantities of military equipment are being submitted by civilians and servicemen to the Australian Army Inventions Directorate. Each idea is tested to prove or disprove its practicability. Occasionally the ideas are improved during the tests.

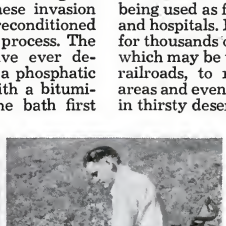
One idea that has already found application is the conversion of millions of square feet of steel mesh to the manufacture of prefabricated packing crates. The mesh was used during the war to provide a solid surface on the soft soil of beaches and jungles. The idea to make crates from the mesh was suggested by a soldier who had seen many smashed wooden packing cases. The mesh crates are collapsible, being held in shape by clips, and are easily transported when empty. More than 50,000 crates have been made from the unused mesh at base depots alone.

Millions of feet of rusty barbed wire, erected at many strategic points along the Australian coast when Japanese invasion was imminent, have been reconditioned for farm use by a "pickling" process. The method is the least expensive ever devised. The wire is dipped in a phosphatic pickling bath, then coated with a bituminous protective mixture. The bath first makes shining metal of the badly rusted rolls, then the protective treament gives it a dark brown finish.

Bren carriers have been stripped of armor plate and their controls modified in testing their use as farm tractors. More than 20,000 of the vehicles are idle in tractor-poor Australia, where wheat growers face a serious power shortage.

Thousands of 40-gallon steel drums are being used as fat reclaimers at army camps and hospitals. New uses are being proposed for thousands of tons of leftover explosives, which may be used to improve harbors and railroads, to reclaim forests and swamp areas and even to excavate deep waterholes in thirsty desert regions.





Seat for Fishing Boat Also Is Lawn Chair

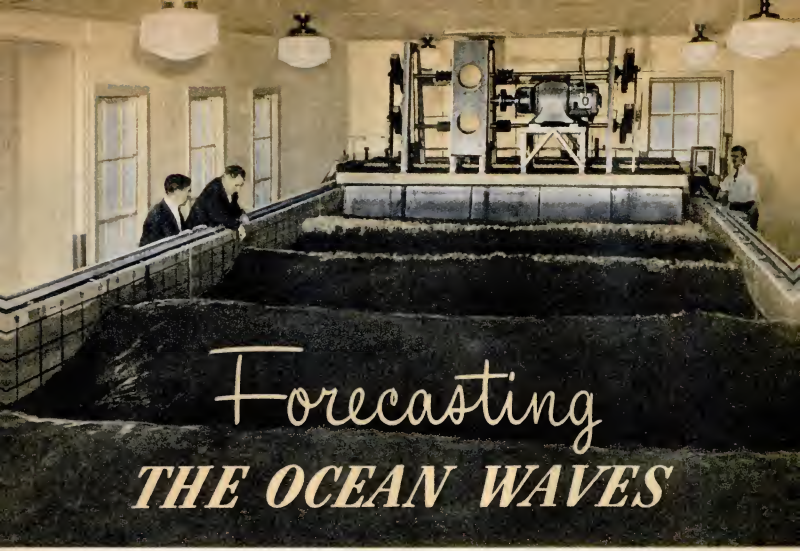
For use either as a lawn seat or fisherman's arm chair, a dual purpose, all steel sportsman's seat can be folded into a compact bundle for easy carrying. The chair, which has a cushioned seat and canvas back, will fit any boat seat or it can be detached and fitted over legs for use on land.

Three-Point Suspension Principle Used in Pleasure Boat

Using the three-point suspension principle widely employed by racing boats to develop greater speed, a new 19-foot stock runabout carries six people at speeds up to 60 miles per hour. At high speeds the boat planes on two underwater sponsons located amidships and on its flat stern. The runabout has a glass-plastic laminated hull, is powered by a 175-hp. marine engine and weighs 2000 pounds. The engine is located in a compartment in the stern and is readily accessible through a rear deck that is raised like the hood of an automobile. The seats are upholstered in waterproof plastic materials and the instrument board carries a clock and push-button radio receiver. The hull is of streamline design. A 21-foot, eight-passenger version of the same design, powered by twin 275-hp. engines, travels up to 70 miles per hour.

Levers on Lawn Mower Control Height of Cutting

Equipped with two levers on the handle for height and blade control, a power lawn mower makes it possible to cut grass to a desired height. One of the levers controls an automatic leveling device to fix the height of the cut. The other adjusts the proper clearance between the cutting blades and the bottom knife. This can be controlled with micrometer accuracy to within .001 inch, which is said to give more efficient cutting and quieter operation. Both levers can be set without using a wrench or screwdriver. The 21-inch cutting blades on the mower extend three inches beyond the driving wheels on each side to make it easy to trim around trees, flower beds, rocks and other obstructions. A 17-inch hand mower with similar controls also is available.



Forecasting THE OCEAN WAVES

By Andrew Hamilton

THE sea played a grim and ghastly joke upon the world last April Fool's Day. Powerful tidal waves, started by an underwater earthquake near the Aleutian Islands, battered seacoasts in the Hawaiian Islands, Peru, California and Alaska. More than 100 lives were lost and property worth $10,000,000 was destroyed.

Could this disaster have been prevented?

"Probably not," says Dr. Harald U. Sverdrup, director of the University of California's Scripps Institution of Oceanography and one of the world's authorities on ocean currents.

"Tidal waves are started by earth slippages—and as yet science has not been able to predict earthquakes. It is true that earth shocks were recorded by seismographic instruments within a few minutes whereas it took the tidal waves, traveling at 400 miles an hour, four hours to reach Hawaii and eight hours to reach southern California.

"However, earth shocks are recorded every day and there is no way of determining accurately which ones set off these rare tidal waves. The factor of tide and swell also must be taken into consideration. At low tide, little or no damage may be done; at high tide and with a high swell, considerable damage may be expected."

Machine-made waves are measured and studied at the Woods Hole, Mass., Oceanographic Institution. Tripod marker (below) guided landings on Okinawa

Relation between wave speeds and water depths was studied in a glass case to aid amphibious warfare

Dr. Sverdrup says the April 1 wave may have been caused by a block of the sea bottom, several square miles in area, slipping a couple of feet. The effect produced was like throwing a rock into a pond. Giant ripples radiated in all directions. In the open sea, these huge ripple-waves could not have been seen. No ship captain or transpacific plane pilot reported them. The crests may have been 100 miles apart.

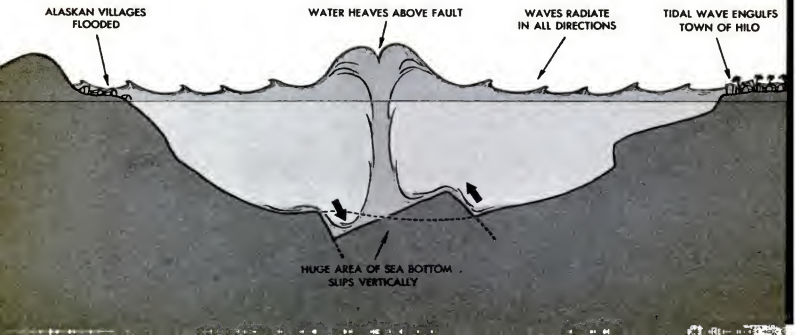
"Greatest damage occurred when the waves reached land—especially in the vicinity of Hilo, Hawaii," Dr. Sverdrup explains. "The sea level rose 15 or 20 feet. In passing over a reef, such as existed there, it took on the characteristics of a 'bore.' The tide came in as a wall of water and smashed stores, piers and homes.

"We are never going to be able to prevent disasters such as earthquakes and tidal waves, but what we learned about the sea in the study of amphibious warfare will enable us to cope better with waves, swell and surf. A network of swell and tide stations throughout the Pacific would help us control the destructiveness of the sea."

A major factor in the success of American amphibious warfare was that our troops and commanders knew about tides, swell, depth, surf and wave conditions before the men hit the beaches.

Back in 1942 Dr. Sverdrup was charged by the Navy with assembling information on the ocean. He was asked to develop a quick method of predicting wave and surf conditions from aerial photographs im-

Tidal waves that struck Hawaii may have been caused by sudden vertical movement of a huge sea-bottom section



Schooled on California beaches, landing craft skippers learned to take advantage of breakers to ride ashore

mediately prior to a landing, and was asked to establish a school to teach Army, Navy and Marine Corps weather officers the science of forecasting sea, swell and surf.

Working in cooperation with the Woods Hole Oceanographic Institution and the department of mechanical engineering on the Berkeley campus of the University of California, Dr. Sverdrup and his assistants laid out a program to help make amphibious warfare successful for the Allies. This meant (1) prediction of sea and swell conditions from weather maps, (2) forecasting breakers and surf when the swell was known and (3) determining surf conditions and offshore depths from aerial photos.

The program paid off in victories. More than 200 Army, Navy and Marine Corps officers, after attending classes at the Scripps Institution, predicted accurately the conditions of sea and surf in amphibious landings at Sicily, Normandy, Saipan, Guam, Tinian, Palau, the Philippines, Iwo Jima and Okinawa.

More than 100 years ago, the classic theory of waves had been formulated: "in deep water the speed in knots is three times the period in seconds," thus a 10-second wave travels in deep water with a speed of 30 knots; and "the length of a wave is five times the square of the period," thus a 10-second wave has a length five times 10 squared or about 500 feet.

This was the basis on which amphibious landing research was conducted. In spite of the confused, checkerboard pattern of waves in the sea it was found possible to establish a definite relationship between higher waves, wind velocity and the stretch of water over which the wind was blowing (the fetch) or the length of time the wind was blowing, (the duration). The formulation of these relationships in 1943 represents, according to Dr. Sverdrup, the greatest single achievement of the project—a quiet scientific achievement, not as sensational as an atom bomb or a jet fighter, but in its own way quite important.

From weather maps of ocean areas, meteorologists were trained to compute the wind velocity at the sea surface and to determine the fetch of the wind and its duration. With these values they read off from simple graphs the height and period of the significant waves present. Thus, with an 18-knot wind and a fetch of 300 miles they found significant waves were 8 feet high with a period of 6.3 seconds, whereas with a 32-knot wind and the same fetch the waves were 20 feet high with a period of 8.4 seconds.

Aerial photographs were invaluable to the science of forecasting surf and wave conditions. Wave patterns in a single aerial photo would give an experienced observer a mental picture of the ocean bottom. And a series of pictures, taken at a few seconds' interval, would allow him to determine depths to an accuracy of one foot.

When the landings on Sicily were imminent, the Allied fleet ran into a severe storm in the strait between Tunisia and

In a "spilling" breaker the crest rolls over and breaking takes place slowly over a long distance

This is a "plunging" breaker which breaks quickly and over shorter distance than "spilling" breakers

Sicily. On the afternoon of D-minus-1 day it appeared that the fleet might have to turn back and the operation be postponed. However, the Navy aerologist attached to Admiral Hewitt's flagship forecast that the wind would die before midnight and that only moderate surf would be encountered the next morning at H-hour. Operations were continued on schedule and the prediction turned out correct in every detail.

Before the Normandy landings extensive preparations were made to provide correct forecast of surf conditions on the French invasion beaches. The weather situation was unsettled when the great second-front invasion took place but the forecasts were reliable and there was no loss of life from incorrect estimate of weather and surf.

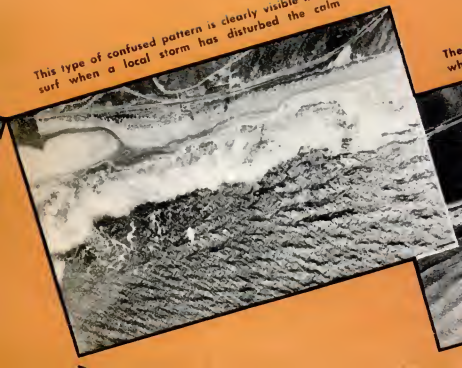
In the western Pacific, meteorologists, however, frequently could use in reverse their knowledge of the relationship between wind and waves. By observing sea and swell they could draw conclusions as to the character of the winds and could improve their weather maps and forecasts.

At Iwo Jima the steepness of the beach contributed to the hazards of the operation. Moderate and high waves broke directly against the steep bench and made the handling of landing craft a tricky task. But this feature had been foreseen and taken into account.

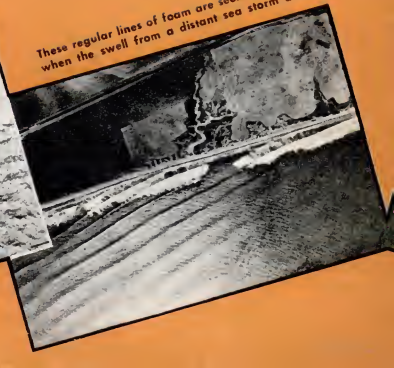
At Okinawa alternate beaches had been selected in order that D-day landings could be made on beaches least exposed to the surf. However, weather conditions on that sunny Easter morning were favorable and landings were made on the beaches which had been considered first choice.

With the end of the war, efforts have been made to forge this war-born science

(Continued to page 232)

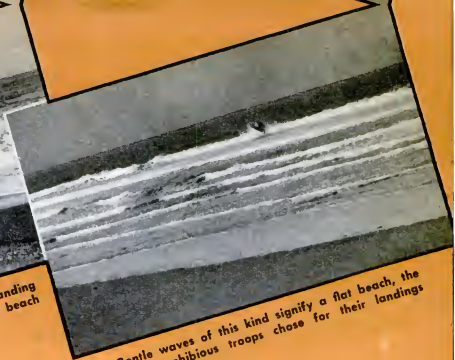


This type of confused pattern is clearly visible in the surf when a local storm has disturbed the calm

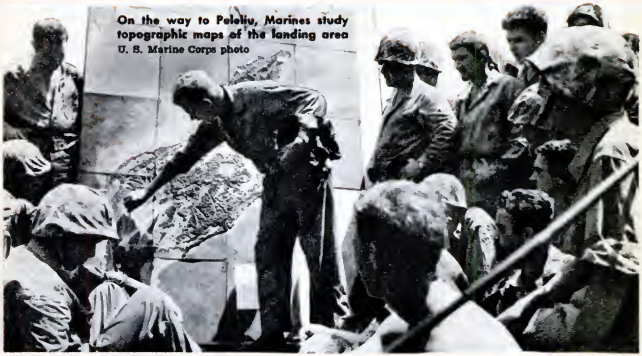


These regular lines of foam are seen in surf zones when the swell from a distant sea storm arrives

Waves breaking in this manner warned our landing crews of the obstacle of an extremely steep beach

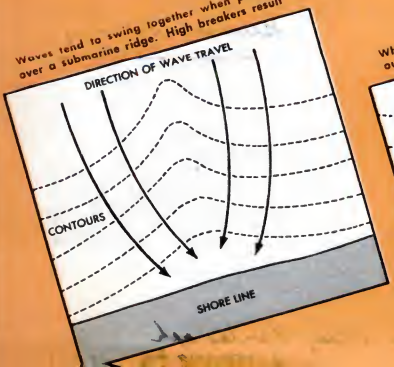


Gentle waves of this kind signify a flat beach, the type amphibious troops chose for their landings

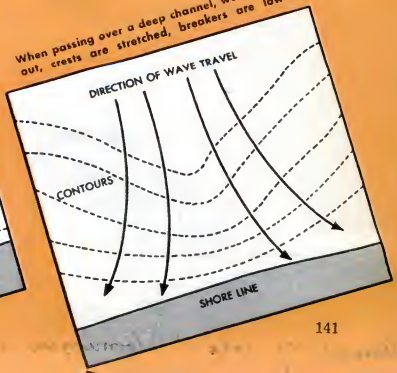


On the way to Peleliu, Marines study topographic maps of the landing area
U. S. Marine Corps photo

Waves tend to swing together when passing over a submarine ridge. High breakers result



When passing over a deep channel, waves fan out, crests are stretched, breakers are low



Two-Passenger Three-Wheel Car Has Engine in Rear

Room for two passengers to ride comfortably is provided in a three-wheel car powered by a 10-horsepower engine mounted over the rear wheels. The same company also builds one and two-passenger motor scooters driven by smaller engines of the same type. Overall length of the car is 80 inches. The wheelbase is 66 inches and the width 40 inches. The 450-pound car will run up to 50 miles per hour and will deliver 65 to 70 miles per gallon of gasoline. Both engine and wheels are spring mounted. The scooters run approximately 100 miles on a gallon of gas and can travel at speeds up to 40 miles per hour.

Driverless Tractor Stops Automatically If It Jumps Furrow While Plowing

General Delivery

Tractors used for plowing can be equipped with a two-wheel guide on the front which eliminates the need for a driver. The guide keeps the machine following a furrow around and around a field. It consists of an old-type tractor wheel guide and disk coupled to a bar about three feet ahead of the front tractor wheels. If the tractor does jump a furrow the power is shut off automatically and the tractor stops. When this happens the tractor must be started again by an attendant, but use of the device allows one man to keep several tractors in operation at the same time. The guide was developed by F. O. Masten of Sudan, Tex. The driverless tractor pulled a plow 24 hours a day and reduced the man-hours needed to plow 420 acres from 1180 to 35.

Mr. Jerry Bold, Bloomington

Coal Conveyor on Dump Truck Is Powered by Engine

Power supplied by the engine drives a conveyor which quickly empties coal from a dump truck. It consists of a trough with an endless belt conveyor fastened to the truck bed. When the truck body is tilted the conveyor remains level, connecting with a delivery trough which also utilizes an endless belt conveyor.

Daily Pantagraph
Bloomington, Ill.

403 N. Scott St.

Pump Engine Drives Midget Automobile

Working without plans, Emory Kent of Wichita Falls, Tex., built a handsome midget automobile which travels 55 miles on a gallon of gas and speeds up to 50 miles per hour. It is powered by a five-horsepower pump engine. Its chassis is made from steel bed frames. Overall weight is 500 pounds. The car measures 86 inches from bumper to bumper and is 51 inches wide.

Giant Magnets Used To Make Atom Bomb

Electromagnets 250 feet long are used in atomic bomb production to separate U-235 from uranium compound. The compound first is vaporized, then ionized or electrified by passing through an electric arc. Then the electrified atoms are given a forward acceleration by passing through more "potent" electric fields. The accelerated atoms move at high speeds in a strong magnetic field which causes them to travel in a circular path. The lighter U-235 atoms travel in a smaller orbit than the heavier U-238 atoms. At the proper point separate containers are placed to receive the U-235 and U-238 atoms.

Mechanical Caddy for Golfers Includes Comfortable Chair

Golfers can loaf over the course with a combination mechanical caddy and comfortable chair invented by Henry R. Sutphen of New York. The golfer's boon has been dubbed the "Takeitezy." Golf clubs are carried in a bag mounted on two wheels. An extension of the aluminum-tubing framework forms an adjustable seat. The inventor has patented another feature of the mechanical caddy—an adjustable handle that can be locked in any desired position to provide perfect balance regardless of the number of clubs in the golf bag.

¶Popular Mechanics is always ready to supply further information to readers about various products described in any issue. Just write to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Ill., for a prompt reply.

Inv. by. Henry Sutphen 40 Wall St, N.Y., N.Y.

"Inside Stuff" for Your Home

1 Pressure cooker becomes a service dish when regulatar lid is replaced by serving lid (inset)

2 Small grips an the handle af a spaan hald a knife and fark as a single unit in picnic baskets

3 Can apener turns the lid upward and also serves as a handle to empty cantents af can inta pan

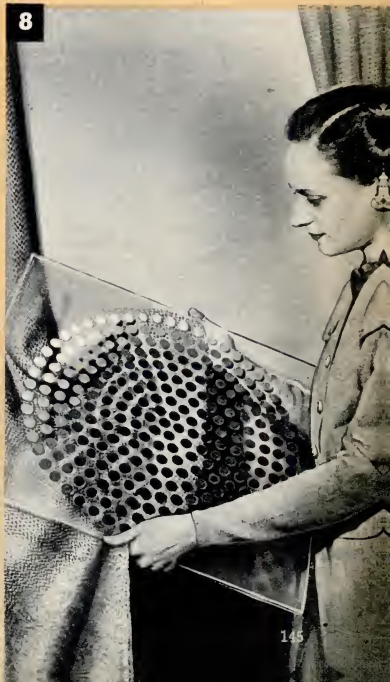
4 Camplete meal can be caaked an the dining raam table with three-burner, fold-up electric range

5 Yaungsters taa big far high chairs can find the right fit in clamp-an seats attached ta chairs

6 Plastic-coated plybaard cabinet has a ventilated hamper campartment and two small drawers

7 Chacalate ar fruit-juice frazen "sticks" are made at hame in plastic mald for use in refrigeratars

8 Charts that contain 1000 calar shades make it easy to select praper paint ta match fabrics



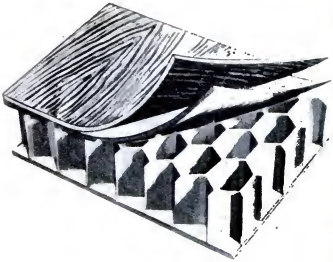
WALNUT HARVESTER has steel and canvas apron which catches nuts knocked down by men on attached towers

POWER SPRAY attached to garden tractor combats insects on trees and plants, develops 300-lb. pressure

TRAILER HITCH has a universal joint which prevents overturning by providing swivel in all directions

FOOT-OPERATED tool selector on garden cultivator gives choice of plow, weeder, cultivator and hiller

'Honeycomb' Structural Material Has Cloth or Paper Core



Resin-impregnated cloth or paper, formed into a "honeycomb" and covered with thin sheets of metal, wood veneer or plastic, has been made into what is described as the strongest structural material of its weight ever developed. Produced by the Glenn L. Martin Company and the U. S. Plywood Corporation, the material may be made with a core thickness of one eighth inch upwards and with width and length limited only by the size of the skin material and the dimensions of presses. Thickness of core and type of skin may be varied with load requirements. Wood veneer may be used alone when little stress is expected or it may be combined with a metal facing where load is greater. The material will be used both as flooring and in structural members of a new transport plane, and is expected to have wide use for walls, ceilings and partitions of railroad cars, in auto and motor truck bodies, and possibly in the home as doors, wall panels or furniture.

Machine Makes Oysters 'Yawn' For Quick Processing

Oysters "yawn" when placed in a machine that tumbles them about, sprays them with water and dunks them in a soda water bath to prepare for quick shucking. This process, developed by Dr. Herbert F. Prytherch, head of the U. S. Fisheries Laboratory at Beaufort, N. C., is patterned after the starfish practice of wrapping five arms around an oyster and injecting into its shell a natural anesthetic to cause the oyster to open up and permit easy access to its "meat." The "yawn" machine is said to save 25 percent of processing costs.

Associated British & Irish Railways photo

BRITISH TRIBUTE is paid to General Dwight D. Eisenhower by naming a locomotive in his honor. The locomotive is the first postwar streamlined engine to be placed in service by the London and Northeastern Railroad

From Brooklyn to Bombay, the whole world receives day-to-day reports on the United Nations' deliberations via a vast communications network

TELLING

By Bill Reiche

ELEVEN men sit around a boomerang-shaped table making world history. What they say and do may affect the lives of every man, woman and child alive today—from Salem, Mass., to Sydney, Australia.

But do they, members of the United Nations Security Council, perform their fateful chores in privacy befitting so solemn a proceeding? They do not! Joe DiMaggio hitting a climactic World Series home run is practically unnoticed compared to the intense concentration accorded the council by the news and communications organizations.

More than 700 correspondents were ac-

TELEVISION PORTRAITS

Edward R. Stettinius and James F. Byrnes, U.S.A.

Andrei A. Gromyko U.S.S.R.

Henri Bonnet France

WWNYC
WWQXR
CBS
MUTUAL
STATE DEPT.
INTERNATIONAL
RADIO
NEWSREELS
NBC TELEVISION

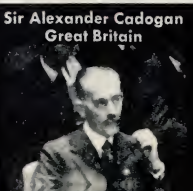
THE WORLD

Official United Nations photos
Spectators, reporters, newsreel cameramen, newspaper photographers and radio announcers train their eyes on United Nations delegates

credited to the council, representing such diverse publications as the Sydney (Australia) Morning Herald, and Variety, the bible of show business, which conducts its operations from the fringe of New York's Times Square. The significantly named Ultima Hora—The Final Hour—of Bolivia was represented at the capital of the world, temporarily set down in the gymnasium of Hunter College in the Bronx. Writers representing newspapers in Calcutta, Jerusalem, Tunis and Scranton, Pa., rubbed elbows with the representative of Vogue.

Radio—local, national, international and foreign—went all out to bring the council proceedings and reports of its actions to a

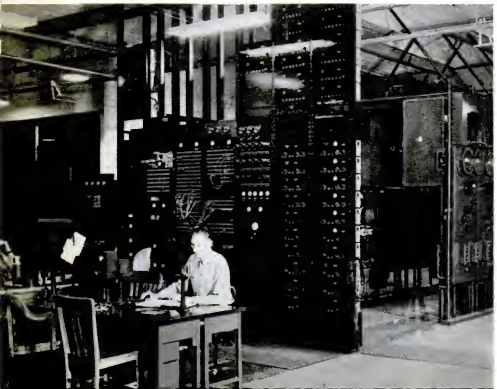
Trygve Lie
Norway


Sir Alexander Cadogan
Great Britain

Francisco Castillo Najera
Mexico

Monitor of sound control at the conference is Major G. R. Vincent. ACR antennas (below) at Brentwood, L. I., beam messages to the world

Communications flashed from the American Cable & Radio operations room (right) via transmitter (below) reach Europe in 10 minutes. Transmitting and receiving equipment handles 38 overseas circuits



vast majority of the world's homes that have receivers.

Four national networks, three international broadcasting systems, three foreign networks, eight stations in the New York metropolitan area and 25 independent broadcasters throughout the nation provided radio coverage never exceeded and perhaps never equaled in history.

This accounts for the readers and the listeners. For those who wish to look at the proceedings there are five newsreels on deck and NBC television.

But even as an army is no better than its communications, a newspaper writer outside of his own city room is helpless without a sure link which keeps him in touch with his office—be it in Brooklyn or Bombay. For this outsize corps of correspondents a vast network of telegraph and cable circuits covers the globe like a giant spider web; multiple radio channels for radiophone and radiotelegraph lace the world tightly.

Work horse of the team of communications organizations doubtless is Western Union, whose telegraph and cable facilities at the Security Council meeting are capable of handling more than a million words a day. Thirty-six wires, 20 teleprinters and 16

lines for international Morse code link the former college swimming pool, where the press room is situated, to WU's telegraph and cable offices in lower Manhattan.

The copy can be transcribed and relayed from either office or a direct circuit can be established to the ultimate destination in instances where arrangement has been made to transmit a considerable volume of copy.

Let's follow a piece of copy from the moment it is completed by a Scandinavian correspondent sitting in the press gallery. He waves his copy and a Western Union messenger darts down the aisle and snatches it. With a few quick strides he is at the pneumatic tube that drops to the press room several floors below, beside which stands another messenger. He rushes the yellow sheets to an operator, who starts the message on its way to the cable office, many miles south near the tip of Manhattan Island. Transfer to the operator handling the wire to Sweden is swiftly accomplished and then the electrical impulses start their long journey under the north Atlantic.

Within an hour—frequently less—the foreign editor of the Stockholm paper is reading the dispatch his colleague wrote thousands of miles away.

Using a supersensitive image orthicon camera, an NBC television technician focuses his camera on the statesmen at the UN meeting

Calls from 500 telephones at the Hunter College headquarters of UN are handled on 12-position switchboards. Below, newsmen working in the press room. Left, radio commentator views a television screen

Newspapermen reach for copies of statement on Spanish situation by Poland's Dr. Oscar Lange

William H. Watts, Western Union chief at Hunter College, reported that the meeting had produced the heaviest cable file on a single subject in American history and that, as usual, the installation of equipment had to be finished in less than enough time.

"When we started to put our machines in here," he said, "there still was water in the swimming pool," and he tapped the temporary floor that covers the "old swimmin' hole" of the collegiate nymphs.

He said the press and communications setup had been so well arranged that there had been few untoward happenings. He did recall that one correspondent came to grief because he knew too many languages.

When Andrei Gromyko, the Soviet representative, made his historic withdrawal from the meeting over the Iranian question, he did not actually depart when he said he would. He waited for his words to be translated into English and French before making his exit. Apparently only one newsman understood Russian and he was off like a rabbit as the words fell from Gromyko's lips.

He might have had a beat of several minutes on all his colleagues of the press, but his locomotion was not as skilled as his linguistics and he fell down an entire flight of stairs. By the time he pulled himself together his time advantage had been considerably narrowed.

RCA Communications is prepared to transmit 200,000 words a day via the air waves—chiefly to European newspapers and press services—but seldom reaches that quota since the maximums are set to handle earth-shaking events which will have every writer pounding his typewriter into a white heat.

This organization boasts that it has transmitted stories from the press gallery to Gothenburg, Sweden, in 10 minutes, but human fallibility sometimes slows down the process. A European correspondent filed his dispatch after obtaining his information from an English language transcript of the day's proceedings. Then he discovered a discrepancy in the French translation. The message was practically stopped in midair, with its extremities in two continents, while the harried reporter figured out which version was correct.

The RCA routine is much the same as Western Union's: correspondent to messenger, to teleprinter, to downtown office. There the message is put on the

(Continued to page 248

Steel Armchair Folds Into Compact Bundle

By merely detaching two clamps and a cross bar, a full-size spring-steel armchair designed for either porch or outdoor use can be folded into a small compact bundle for easy carrying. Only four thumb bolts need be loosened to take the chair apart for folding. The frame is of white enamel and the posture-form seat, finished in Chinese red, apple green or canary yellow, is shaped for comfort. It is light in weight and its finish is rust-resistant. It can be assembled just as quickly as it can be folded.

Positive Cure for Malaria Reported by Scientists

Positive cure for malaria in white patients is now said to exist. Designated only as SN13276, the new drug's value as a cure for Negroes, Chinese and other dark-skinned people must be tested, it is reported to the American Chemical Society, before it can be used for their treatment. It is chemically related to a previously known drug, pamaquin, which had curative properties but could not be used because it was too poisonous. The new cure is more effective and less toxic to human beings. In the same campaign against malaria, tests with young chicks have revealed a new group of synthetic chemical compounds, known as alpha-aminocresols, one of which is 75 times more effective than quinine. Approximately 100 compounds in this group have been tested. While bird malaria is not identical with the disease in man, it is similar enough for testing purposes.

Parke Davis, Squibb

Power Drill That Rides the Rails Can Be Operated by Only One Man

One man can operate a new 130-pound power drill for railroad track maintenance that bores bolt holes in rails of any weight. The drill uses less than one quart of gasoline in eight hours of operation. Because it rides directly along the rail, one man can easily push or pull it into position. The bit can be raised or lowered for accurate drilling, while a crank controls the direction and speed. A spindle chuck is available for drilling holes ¾ to 1½ inches in diameter. Tests show a saving over manually operated drills of 20 cents for each bolt hole that is bored, according to the manufacturer.

¶Every day new products for homes and workshops, farms and factories, are appearing on the nation's markets, and every month you'll find them described in Popular Mechanics. For additional information about these products, write to Bureau of Information, Popular Mechanics, 200 East Ontario Street, Chicago 11, Illinois.

From this pipe line spews forth land-building sand scooped from the mountains of Southern California. Below, giant rock is lifted into place atop dike that is pushing land farther out into Long Beach Harbor

PUTTING A *MADCAP RIVER* TO WORK

By RICHARD W. EMERY

Photos by Ray Chapin

FLOOD-CONTROL experts were the only ones who took the zany Los Angeles River seriously until Long Beach Harbor engineers put the temperamental stream to work.

From the hills above Hollywood where the river originates to its mouth along the ocean shore at Long Beach the stream bed lies empty, dry and sun-baked most of the year, lizards dozing on its sandy bottom. Easterners look at the dry channel and laugh.

"Some river!" they say. "Where's the water?"

When Southern California's rainless summer ends, flood-control experts inspect the 60-mile winding channel. They fret about the next flood. They know the river's Hollywood temperament.

Ordinary California rainstorms have little effect on the river. Even a downpour won't fill the dry banks. Only a hard, driving rain that falls steadily, day after day, until the earth won't absorb another drop will transform the sandy river bed into a roaring, turbulent flood.

Then muddy water spills down the slopes of the Santa Monica and Verdugo Mountains, the San Rafael Hills. Storm drains funnel the flood into the river channel. The Los Angeles River comes to life. From its sodden banks spectators respectfully eye the sweeping milk-chocolate current. Down through Movieland the river churns, scooping mud from around Studio City, Universal City and the

Ships unload at a completed pier in the harbor. The land was built of silt from the Los Angeles River. Below, sandy channel of the river (foreground) sweeps past the harbor

Reinforcing rods for pier are placed in tubular piles that sink deep into the earth 40 feet beneath water surface

Walt Disney Studios. Southward, around Mount Hollywood, it strikes a foaming curve. Then, right through the heart of Los Angeles, the West Coast's most populous area, it hisses, eager to reach the sea.

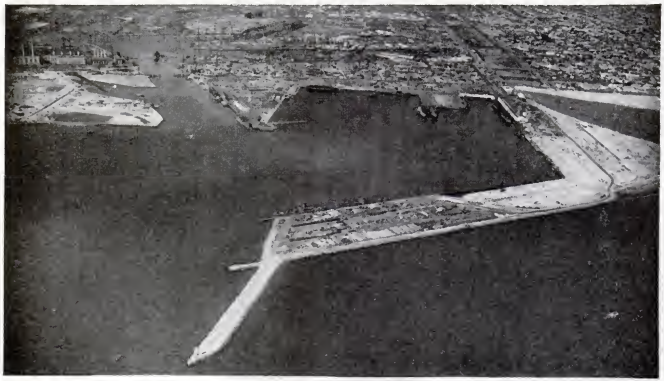
At times the rampaging river has borne on its crest such trophies as bridge timbers and chicken coops, shingle roofs and palm trees. When the water subsides, beachcombers have found rattlesnakes, pigs, dogs and chickens along the river bottom.

But derelict debris is not all that the madcap river carries at flood time. It hauls sand. Sand by the millions of cubic yards. Sand from Hollywood hills and lowland suburbs, from Van Nuys, Burbank, Glendale, Los Angeles and Long Beach.

A few years ago the stream dumped its load far and wide into the ocean, where currents swept the sand away. Now Long Beach Harbor engineers are transforming the sand into dikes and harbor areas.

The Port of Long Beach is the east section of a crescent-shaped harbor several miles long. It is protected from the open sea by federal breakwaters lying three miles offshore in 50 feet of water. The Port of Los Angeles occupies the west section. In the early months of the war the Navy acquired a mile and a half of the Long Beach waterfront and built the $100,000,000 Roosevelt Base. The Port of Long Beach had counted on the land for future growth. After losing it to the Navy, the port faced

Ten million cubic yards of sand carried by the capricious river were poured into these moles and piers



the task of building new land in outer harbor depths.

Back in 1937 the Port of Long Beach struck oil on its own land. By 1938 oil revenue was pouring into its harbor development fund at the rate of $3,500,000 per year. The Board of Harbor Commissioners fostered a plan for creating huge land fills. Upon the fills would be built the most modern marine terminals and harbor facilities that could be designed. The board laid out a $59,000,000 "Comprehensive Plan."

But problems faced Port Manager Alois J. Amar and his chief engineer, Robert R. Shoemaker. The Army wanted to keep the river mouth open to prevent inland floods. Both the Army and the Navy wanted harbor facilities.

The Port of Long Beach, with oil wells bristling from its land, naturally pushed land-building operations. New land would provide port facilities and space for more oil wells. And here in the river was sand for land-building—sand which would be replenished every time the river went on a rampage.

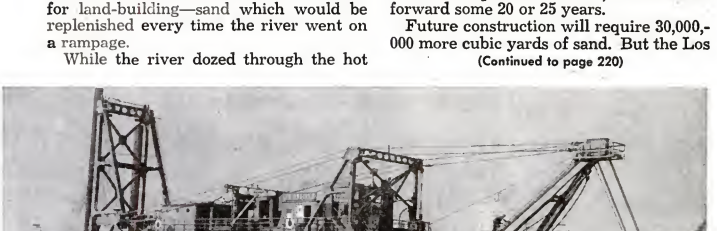
While the river dozed through the hot summer, workmen constructed a curved jetty of granite, leading southeast into the harbor from the river's west bank. The next time the river came foaming out into the ocean, sand-laden and angry, it bumped headlong into the jetty. The current whirled and eddied—then dropped its sand.

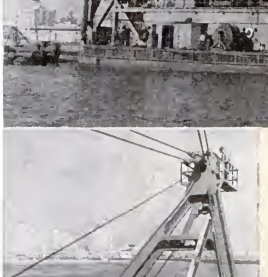
Big dredges came to eat into the silt on the harbor bottom, driving it through pipe lines to areas enclosed by new dikes. The areas became solid land and the port builders constructed wharves, warehouses and railways.

Through the war years, the port invested $7,000,000 in new construction. Ten million cubic yards of sand carried by the Los Angeles River went into the construction of moles and piers. The Army took over many of the new facilities for its port of embarkation. On June 30, 1945, the port launched its $14,735,000 "Five-Year Plan" for constructing the next units projected in the "Comprehensive Plan," which looks forward some 20 or 25 years.

Future construction will require 30,000,000 more cubic yards of sand. But the Los

(Continued to page 220)





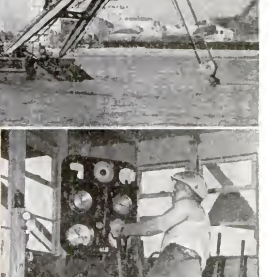
Fifty feet beneath this giant dredge its cutter is biting into the sandy floor of the ocean, boosting silt through a pipe line to new land fills

★ ★ ★

Left, giant A-frame supports the five-bladed rotary cutter on dredge that eats into the sandbanks. Numbered scale tells depth of cutter

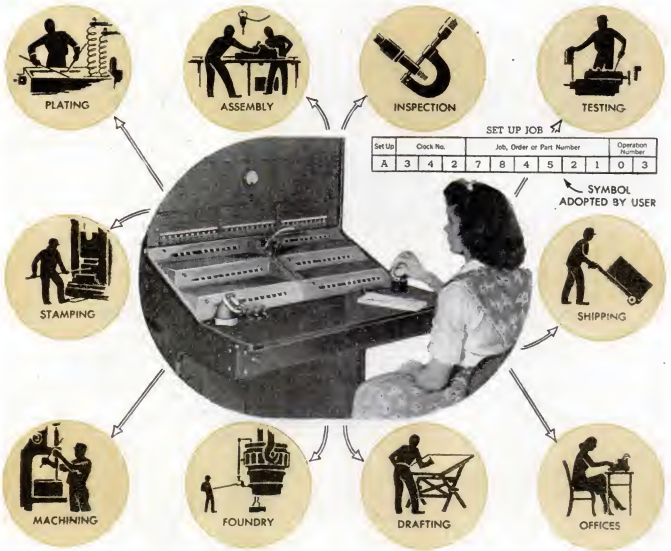
★ ★ ★

Right, leverman's problem is to keep a steady flow of solid material in suction line. Overloading with solids may stop flow, cause delay



"Party Line"... In Code

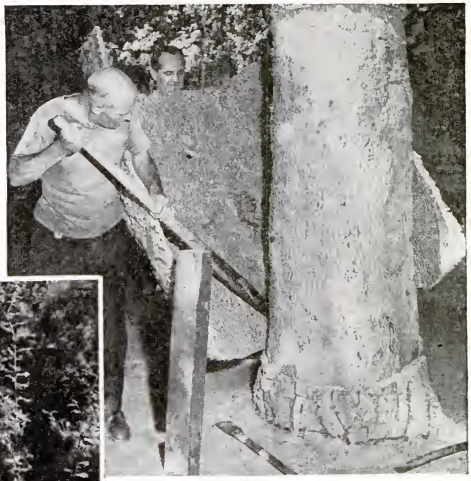
BETTER control of production and record keeping is made possible with a voiceless communication system for factories. To eliminate possible errors in voice transmission, messages are sent in easily remembered code simply by dialing letters and numbers on a dial similar to that used on telephones. One central unit is employed with as many substations as are needed. As the message is dialed it remains recorded until cleared at both stations. This system is highly flexible and can be used to show when new orders are received, the quantity and products for which the order calls and its progress through the factory until its shipment. The system also can be employed to keep a check on raw materials, machine breakdowns, time and cost records and other data. When an operation is finished, the data can be sent to the central station to provide a complete picture of operations.



25th + Potrero Sts. San Francisco, Cal.

Cork Oak Tree Farms Boost New U. S. Industry

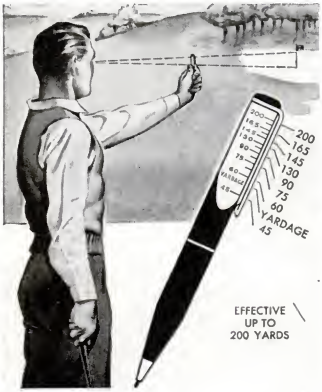
Production of cork for a thousand or more useful tasks is fast becoming a big American industry although the Mediterranean was our chief source of supply a few years ago. In California alone more than 4000 mature cork oak trees, some dating back to the days of the Spanish settlement, supply bark from which many tons of cork are produced. Since 1940, countless acorns and more than half a million seedlings have been distributed, free of charge, by the Western Crown Cork and Seal Company so more and more



From seedlings (left) grow cork oak trees which are stripped every 10 years to yield a rich harvest of cork bark. Strippers use Portuguese ax to remove the tough bark

cork oak trees will be grown. It requires about 15 years for a tree to reach the productive stage, but the trees live 150 to 400 years. Some huge trees yield as much as 1050 pounds of good quality cork. In preparing cork for commercial use, slabs are removed from trees and allowed to season in the sun for two weeks. Then the slabs are placed in vats where the bark is softened and dirt, sap and tannic acid are removed. Then the bark is dried and made into bales weighing from 250 to 500 pounds

Pencil-Meter Is Help to Golfer Approaching Green



Guesswork in judging distances is avoided with a pencil having a graduated scale designed to aid golfers. The golfer, when approaching the green, holds the pencil at arm's length and sights over it to the flag. The place where his line of sight to the base of the flagpole crosses the built-in scale will tell him the distance to the cup and the proper club to use for shots of that distance.

Collapsible Live-Bait Container Saves Space in Car or Boat

When collapsed for carrying in a luggage compartment or boat, a rustproof, portable live-bait box occupies less than a cubic foot of space. When assembled, the rustproof box is 20 inches in diameter and 12 inches high. It can be collapsed or assembled in less than one minute without tools.

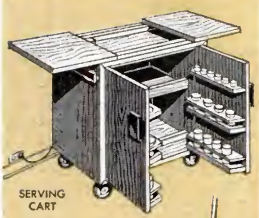
"Snap-On" Fluorescent Shield Reduces Glare From Tube

Glare from fluorescent lights is eliminated by a shield which diffuses the light evenly and reduces eyestrain. Made of aluminum, the decorative white enamel fixture fits over fluorescent tubes and is clamped on with snap-on clips that require no screws or bolts. The shields are available in 20-inch lengths for 20-watt lights and 48-inch lengths for 40-watt lights.

Dolly "Totes" Outboard Motor

Outboard motors can be transported to and from the waterfront by a combination dolly and motor support. Providing a support in upright position for adjusting motors, the unit can be tipped over to hold the motor in position for servicing. While in upright position the motor cannot be tipped over accidentally. A removable drip pan catches leaking oil and a large steel roller prevents sinking in soft ground. The unit is available in two sizes to handle up to 60-horsepower motors.

The Craftsman



SERVING CART

Are you looking for a place to live, at least temporarily? Then turn to page 170. We're not suggesting that you start chopping away at your neighbor's favorite elm, but the log-cabin story may present a partial solution for your housing need. It tells how you can build an attractive cabin from various types of logs, some field stone and odd pieces of used lumber. Of course, when it's finished you'll want to take a picture of it to show around—one that has good composition—so try "shooting" through a mask as told in a photo yarn on page 188. There'll be days, too, when you'll have to take a rain check on outdoor activities and that will be the time to get going on the unusual serving cart described on page 162. It's a kind of rolling "butler" from which to serve buffet style at mealtime. Also along the shop line, a feature on page 202 acquaints you with a short cut in laying out sheet-metal patterns, and on page 181 there's an excellent article on making air filters for your windows. Besides these feature stories, there are many other practical ideas to keep you going till we come around next month

LOG CABINS

SHEET-METAL LAYOUT

ROOM DUST FILTER

PHOTO COMPOSITION

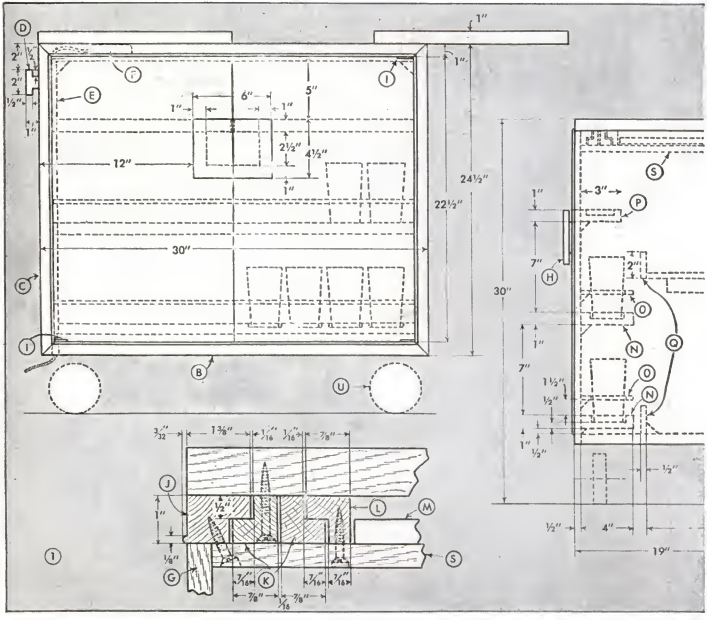
Utility SERVING CART

Streamlined version of the tea wagon is wired for toaster and electric plate. Has plenty of room for dishes and glassware

By Gene Russell

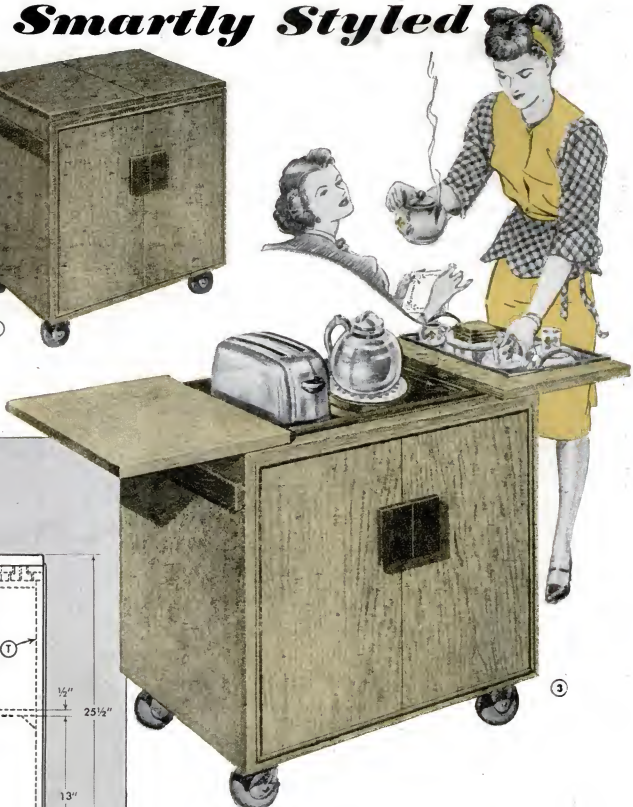
WHETHER it's your turn to entertain at bridge or you're just having the neighbors in—that's when you'll want to wheel out this smart looking serving cart. It's just the thing beside the bridge table for coffee and light snacks, or to assist in serving at a small dinette table. There's plenty of space for dishes and glassware as indicated in Fig. 4, and the divided top slides back to reveal a metal tray and an outlet to plug in a toaster and electric plate as shown in Fig. 3. The whole thing closes up into the neat little cabinet in Fig. 2 which can be pushed into a corner out of the way when not in use.

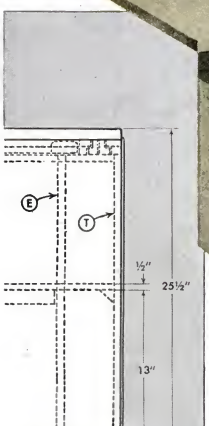
Construction is a fairly simple joining job as detailed in Fig. 1. Although standard 1 1/16-in. solid stock is called for, which allows 1/16 in. for dressing, construction can be of 3/4-in. plywood if the dimensions are changed and minor alterations are made in the assembly. Panels for the sides and bottom of the cabinet are built up in width from several pieces doweled and glued edgewise. From the pull-apart view in Fig. 5 you can see how the pieces go together. Note that a small beading is run on the inner edges of the panels. If the mitered corners specified are difficult for you to cut, the pieces can be butted and fastened with screws driven at an angle through the bottom and into the side. If mitered, nails can be driven up from the bottom without showing. Four rabbeted rails join the end members at the top, two at the front and two at the back. Note in Fig. 5 that rails J are mitered and rails L are set flush in mortises located ac-



Furniture You Can Build p 136

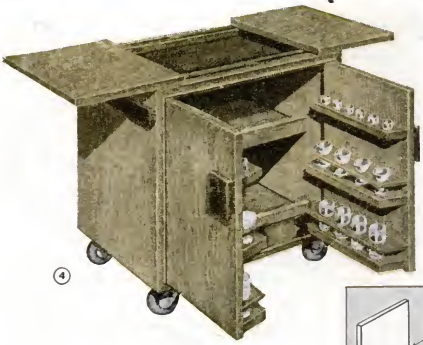
is Smartly Styled



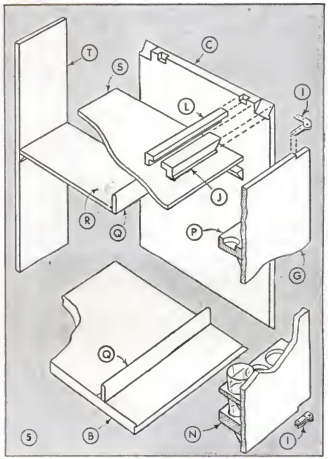


MATERIAL LIST

Part	Required	Size (Finished dimensions)	Name
A	2 pcs.	1 x 15 x 19 in.	Top
B	1 pc.	1 x 19¼ x 30 in.	Base
C	2 pcs.	1 x 19¼ x 24½ in.	Sides
D	1 pc.	1 x 2 x 19 in.	Push handle
E	1 pc.	¼ x 23½ in.	Thin-wall conduit
F	1	Extension cord and double receptacle	
G	2 pcs.	½ x 14 x 22½ in.	Doors
H	2 pcs.	⅜ x 3 x 4½ in.	Door handles
I	4 prs.	Concealed hinges (type shown)	
J	2 pcs.	1 x 1½ x 30 in.	Outer guide
K	4 pcs.	1 x ⅞ x 16¾ in.	Slides
L	2 pcs.	1 x ⅞ x 29 in.	Inner guide
M	1	20-ga. sheet-metal tray (removable)	
N	4 pcs.	1 x 4 x 14 in.	Shelves (glasses)
O	4 pcs.	¼ x 4 x 14 in.	Retainer strips
P	2 pcs.	1 x 3 x 14 in.	Upper shelf (door)
Q	2 pcs.	½ x 2 x 28 in.	Bottle shelf (front)
R	1 pc.	½ x 13 x 28 in.	Bottle shelf
S	1 pc.	½ x 18 x 28 in.	Tray baseboard
T	1 pc.	½ x 22½ x 28 in.	Back
U	4	4-in.-dia. rubber wheels (2 swivel type)	



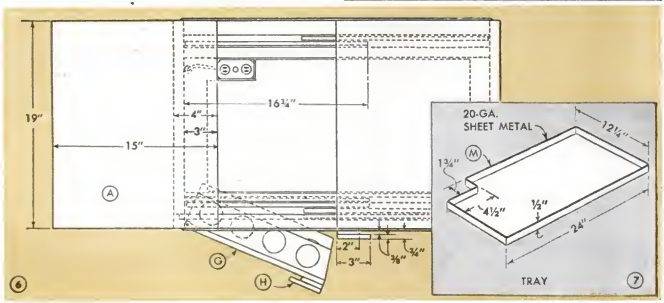
the type of concealed hinge to use. Finally, counterbored racks are attached to the inside of the doors for small glasses, and a two-part knob, built up of two blocks, is attached with screws from the back, one half to each door. A handle for guiding the cart is attached to the left-hand end near the top. Any suitable rubber-tired truck casters, about 4 in. in diameter, will do, although two of them should be of the swivel type to make the cart easy to steer.



cording to the sectional detail in Fig. 1. When these are in place, the back is fitted to set-in the thickness of the beading.

At this point the sliding top must be attached to slides K, each half of the top being fastened to one set of slides. Notice in Fig. 5 that one set extends past the other to provide a stop so that they cannot be pulled all the way out. Pieces of thin cardboard inserted between the slides and guides before the former are screwed to the top will prevent binding. Next, panel S, which forms a recess for the tray detailed in Fig. 7, is installed. This is screwed to rails J and L as in Fig. 1 and is cut to allow the doors to fit flush when they are hinged. A two-plug receptacle is located as in Fig. 6 and is wired with an extension cord that runs down through a length of conduit and out the bottom of the cabinet.

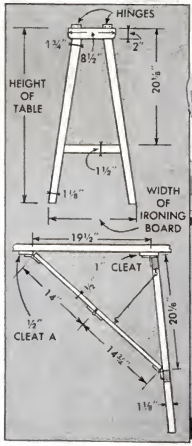
This leaves the doors to be fitted and hinged. Like the back, the doors are set-in the thickness of the beading. Fig. 5 shows



100 W.P.

Ironing Board With Folding Legs Is Made Easily

Permanently attached to an ironing board, this half stand unfolds to support one end of the board while the other end rests on the edge of a table, counter or laundry tub. The board can be made from odds and ends of lumber, five hinges and a short length of stiff wire. The pieces of the leg assembly may be joined with screws, dowels or tenons. If the dimensions given are followed, the stand will fold flat against the board. To allow for final adjustment, cleat A should be mounted after all the folding members have been joined. A hook made from stiff wire holds the leg brace in position to prevent the stand from collapsing.—J. Modroch, Danbury, Conn.



Palm Reel Attached to Old Glove Simplifies Flying Kite

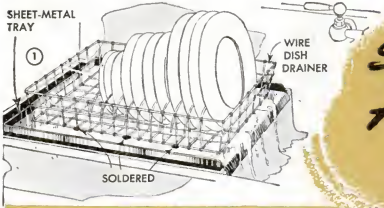
You won't get cord burns on your fingers if you use this "reel" which is attached to a leather glove. The reel is simply a wooden cleat riveted to the glove and secured with copper washers inside the palm. Or the ends of the rivets can be peened against a strip of sheet metal. Any hardwood will do for the cleat. In use, the glove is worn on the left hand and the string is wound or unwound with the right hand.

Wire Springs Hold Cut Flowers

For short-stemmed flowers, or to even up short and long-stemmed flowers, use coiled springs similar to the ones shown. These are fastened to the edge of the vase and the stems are slipped through them, then adjusted to the desired height.

Safety Glass for Playroom

For youngsters who pound on playroom windows with their hands, some protection is obtained by shatterproofing the windows. Several thicknesses of Cellophane may be applied to both sides of the window to obtain this effect. For divided or small panes, the Cellophane will have to be cut to size.—E. L. Stone, Hopkinton, Mass.



Solving Home Problems

1. Sheet-metal tray furnishes protection for linoleum-covered drainboards. One side of the tray forms a lip for water to drain into the sink. A dish drainer is soldered to the tray

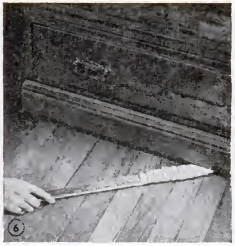
2. To keep a mirror from fogging, apply a film of soap with a slightly moistened finger and then polish the glass with a cloth or cleansing tissue. This will keep a mirror clear for some time

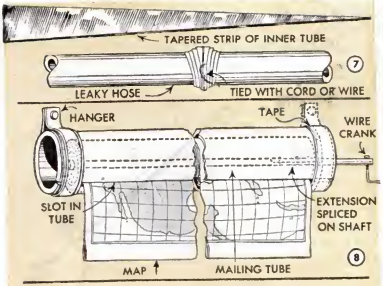
3. As a means of identifying individual towels hanging from the same rack, one woman clips spring-type clothespins to the towels. Each pin has the name of a member of the family on it

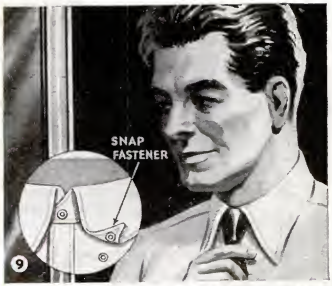
4. Instead of using a silver spoon to measure out bleaching solutions, which may discolor the silverware, use a plastic-type measuring spoon. Attach it to the bottle with a poultry leg band

5. When exposed to air, cut grapefruit soon becomes dry and hard. To prevent this next time you have half a grapefruit left, place it face down on a plate and store in the refrigerator

6. A yardstick or other flat stick wrapped with a length of oil-treated cheesecloth makes it easy to clean dust from under a bookcase, piano or other furniture that is too heavy to move easily







7 When a garden hose develops a leak a good temporary repair is made by wrapping a tapered strip of inner tube over the hole. The strip is stretched as it is wound and tied with wire

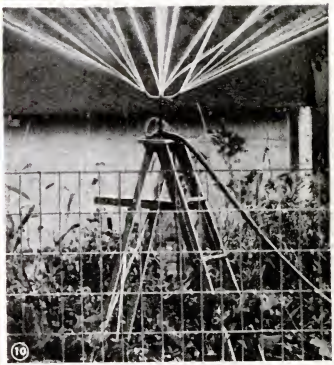
8 Slotted lengthwise and hung by tape at each end, a mailing tube provides protection for a large wall map. A dowel handle spliced to the map shaft serves as a crank to roll up the map

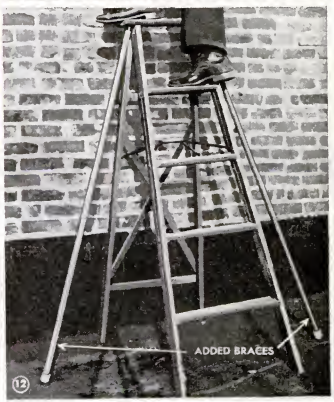
9 The ends of a shirt collar will remain neatly in place and not curl if each one is held down with a small snap fastener. Sew one half of the fastener to the collar and the other half to the shirt

10 Elevating a revolving lawn sprinkler on a stepladder will permit watering a greater area with less danger of damaging tender plants. Also, the sprinkler will require moving less often

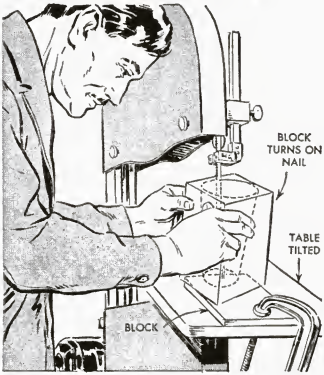
11 Filled with light oil, an atomizer provides a simple way of oiling a clock without dismantling. Squirting oil through a hole in the case will deposit a fine mist on hard-to-reach parts

12 There's less chance of your stepladder tipping sideways if you fit it with broomstick braces as shown. The ends are capped with rubber crutch tips and pivoted at the upper end to fold flat





Wooden Plugs Cut on Bandsaw By Using Simple Jig



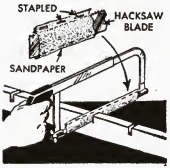
Instead of shaping them on a lathe, one craftsman found that with the aid of this jig a number of large, tapered wooden plugs could be cut on a bandsaw more easily. A nail is driven through a piece of wood near one edge and the block is centered on this. The board then is clamped to the bandsaw table which is tilted to get the correct taper. The plug is cut by rotating the block on the nail. Note that the nail is near the edge of the board so the bottom of the plug will clear it when being cut.—E. H. Morrill, San Rafael, Calif.

Steel Wool Cleans Stove Burners

Aluminum burners in domestic gas ranges are kept clean and bright by using steel wool to polish them at weekly intervals. Pipe cleaners will remove steel-wool waste that is caught in the burner holes. Any small bits of steel that may drop into cracks or on flat surfaces of the stove can be picked up with a magnet.

Jack A. Bristol, Portland, Ore.

Easy Way to Sand Narrow Slots



Narrow slots are easily sanded with sandpaper which is fastened around a hacksaw blade. The blade is removed from the saw and the paper is stapled over it so that the teeth point toward the stapled part. When used, the blade is inserted in the reverse position so the teeth will not cut the paper.

Opie Read, Jr., Chicago.

Leaks in Inner Tube Located With Smoke-Filled Glass

If an inner tube has a slow leak that cannot be located, try this trick. Fill an ordinary glass tumbler with tobacco smoke and immediately invert it over the tube, keeping the tumbler and tube in close contact. Then slowly slide the glass over the surface of the tube. When the tumbler passes over the leak turbulence will be noticed in the smoke.

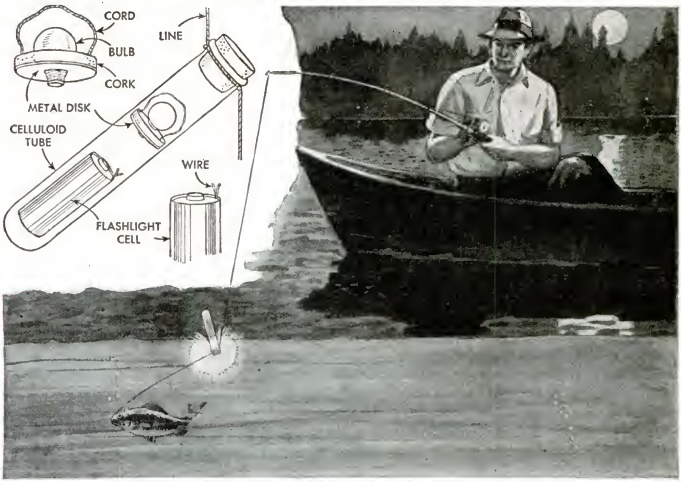
Tommy Laird, Waverly, Ia.

"Water Wheel" at Side of House Is Used as Flower Garden

Built against the side of a house, this imitation water wheel, which is made of 2-in. lumber, will transform the house into an old mill. To add to the decorative effect, the wheel can be used as a novel flower garden, the "paddles" being filled with soil for plants.

Paul Hadley, Philadelphia, Pa.

Illuminated Night Float Glows When Fish Bites



Fishermen who work the ponds, lakes and river backwaters where night fishing for catfish, bullheads and other night feeders is permitted will appreciate this illuminating fishing float. He's hooked in a flash, so to speak, because the float flashes a light at the slightest nibble. It consists of a penlight cell which slides inside a glass or celluloid tube to make contact with a bulb when the tube is tipped. Any test-tube type of vial will do—an envelope moistener makes a good one. The bulb is held in a cork disk which is cut to wedge inside the tube and then is faced with a metal disk through which the bulb is screwed. A cord handle permits removal of the cork. The cell makes contact with the metal disk by a piece of lamp cord, stripped of its insulation and inserted between the cell and its paper covering. The amount the wire should extend is determined by actual test. It must permit the bulb to make contact with the positive or center element of the cell to complete the circuit. The float is attached to the line at the neck of the tube as shown so that a pull on the hook will tip it and cause the cell to slide against the bulb. The tube, of course, is corked tightly.

Candle Rubbed on Inked Address Will Prevent Smearing

During the winter, or during rainy weather, the ink-written address on a package may become smeared by snow or rain so the writing is illegible. One way to prevent this is to rub a candle over the writing to form a protective surface that is waterproof.

¶ If hot plates and dishes have left disfiguring marks on a dining-room table or other polished wood surface, use spirits of camphor to remove the spots. Rub lightly with a soft cloth and when the stain disappears, polish with a soft duster.

Book for Boys Rep. WTM '48 – ~~which is out of print~~

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The "KNOW HOW"

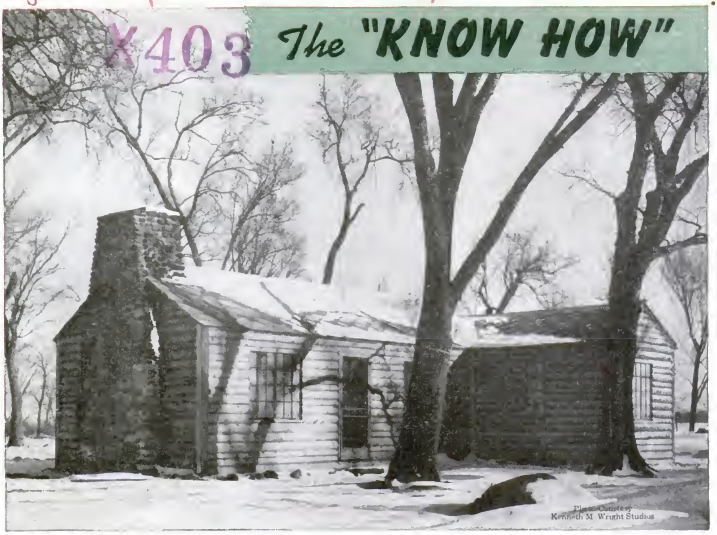


Photo Courtesy Kenneth M. Wright Studios

By Hi Sibley

Slab siding and conventional construction make this type of cabin suitable for year 'round living. It can be fitted with all modern conveniences, and insulated walls and ceilings make it snug and warm

MOST of us enjoy working out the plans for a new home, even the rather drab business of cost accounting, figuring material lists and so on, but the thrill of construction is lost as this usually is done by skilled tradesmen, and to them it's just another house. But a log cabin of your own in the woods or on a lake shore or near some secluded stream—that's something else. There's one sure way to get a real thrill out of owning a log cabin—start from scratch and build it yourself. It's true that it's going to take some work before you get to that last nail in the shingles and that last stone in the fireplace chimney, but once completed, the pride of ownership and the satisfaction of a job well done make it worth while.

Where there is plenty of standing timber the construction of a log cabin is a matter of labor rather than expense, and if the prospective owner builds it himself the outlay will be negligible, the cost of any special work depending, of course, on the type of structure. If you build in a heavily wooded area, first get the advice of the local forester and then select trees that are straight and of minimum taper. It's best to avoid all hardwoods because of weight and toughness when cutting. Pine, cedar, hemlock, tamarack and balsam are suitable, but birch, willow, aspen, basswood and cottonwood are unsatisfactory. If you wish to remove the bark and preserve it for decorative effects, peel it off, lay it flat on boards and weight it to dry as in Fig. 5. It is best to cut the trees in the fall and stack the logs loosely, as in Fig. 4, to season until the following spring or summer—longer if possible. They will be easier to handle if well dried. For trimming the logs, such as when squaring or making one side flat, a broadax is best, although an ordinary ax may be used. An adze also is handy in roughing-out work.

Foundations: The simplest foundation is a stone pier at each corner of the cabin. Use two flat stones as in details B and C, Fig. 6, to keep the logs well up from the moist ground. Do not cement the stones together. Support them on a concrete base poured in a hole in the ground as in detail

# of LOG CABIN BUILDING

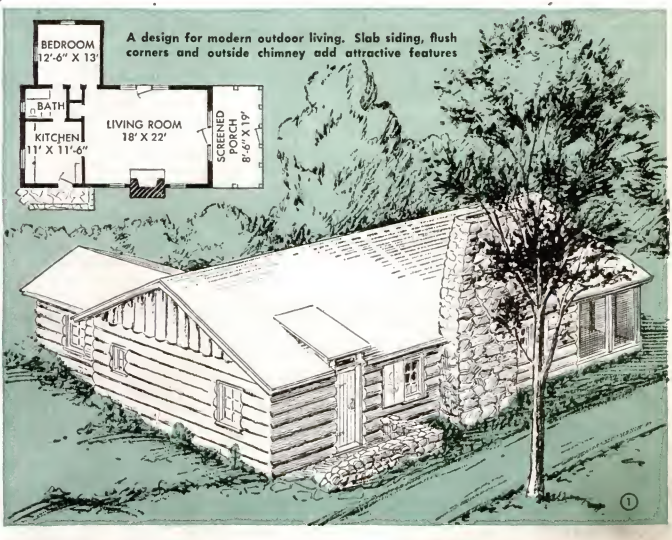
B. It also is permissible to set the sills up on posts, cedar or redwood preferred, digging the hole below the frost line and setting the post on a rock in the bottom, detail A. All posts or logs in contact with the ground should be thoroughly creosoted, working the liquid into all cracks.

Corner joints: Several methods of forming corners are illustrated in Fig. 7. One of the simplest methods is to cut away half of each log end, as at A, and drive spikes as you build up. To many builders the method shown at B makes a more attractive corner as the whole end of each log is exposed. Corners of the types detailed at C, E, G and H in Fig. 7 also are widely used in cabin construction, but the two types D and F are perhaps more generally favored by woodsmen because in both cases the joint will shed water more effectively. These joints are the strongest of all because of the interlocking V-cuts. The dovetailed corner, Fig. 7, E, is equally good but requires very careful fitting. Chipping and notching can be eliminated by making corners as in details G and H, but the construction is not as strong or durable. These two methods are recommended only for temporary construction.

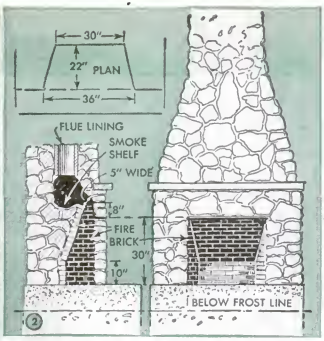
Log-cabin siding: Ready-cut slabs, which resemble logs on the outside, Fig. 1, simplify construction greatly, and having a ship-lap joint, Fig. 3, they do not require caulking. These are nailed to conventional framing in the same manner as any lapped siding. Ready-cut slabs usually are mitered at the corners or a corner piece is fitted as in the upper left-hand detail of Fig. 3.

For a year 'round cabin, a hunting lodge or clubhouse where expense is shared and warmth is essential, an insulated wall can be made as in the lower detail of Fig. 3. In this the slab siding is used inside and out, with insulating board between, forming a double air space. This construction includes a concrete subfloor, giving another air space beneath the wood flooring.

Sills: A simple way to install sills is to support joists on a 2 by 8-in. support spiked to the bottom log, detail C, Fig. 6. The joists are spaced as in standard construction, with bridging between. Another



A design for modern outdoor living. Slab siding, flush corners and outside chimney add attractive features



Properly made, a fireplace can give both atmosphere and comfort. Structural details above at the right show the proper throat construction to give maximum efficiency. The dimensions should be followed quite closely

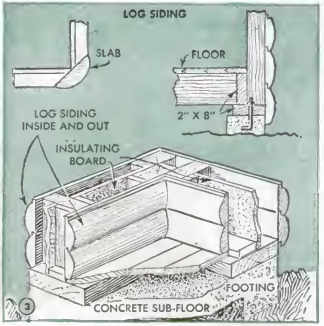
method is to notch the sill log for the ends of log joists, which have been trimmed as indicated in detail D, Fig. 7. Tops of the logs are trimmed flat to make a suitable bearing for the flooring.

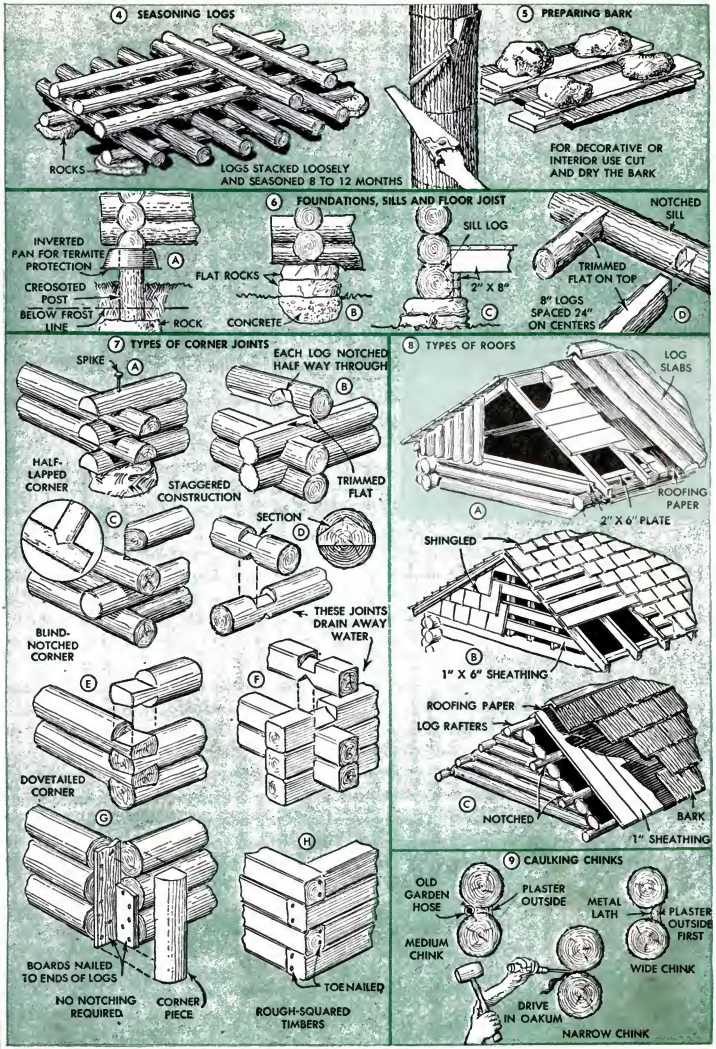
Rafters and roofing: Logs of 4-in. diameter and larger are often used for rafters as shown at C in Fig. 8. These are notched into the end logs and should be as straight as possible, as well as trimmed flat to support the sheathing which is laid edge to edge for roofing paper. For a shingle roof, and conventional 2 by 4-in. rafters, detail B, the sheathing boards may be spaced 2 to 4 in. apart. Slabs over roofing paper and sheathing make a rain-tight and picturesque treatment as in detail A, and bark also can be used in a similar manner over the roof boards as in detail C.

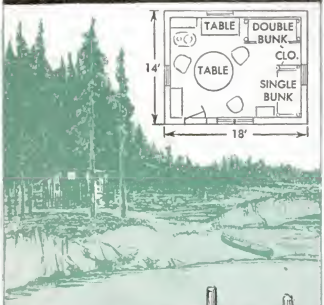
Likewise there are three or four interesting ways to treat gables, three of them shown in Fig. 8, A, B and C. Vertical lines relieve the monotony of horizontal logs or board-and-batten construction in the gables. Shingles, laid irregularly, also are popular. In each case the gable material should extend down over the plate log.

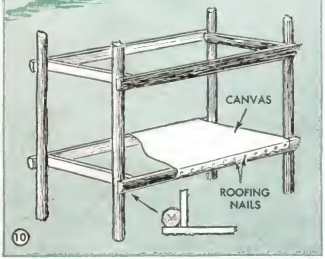
Slab shack: Reduced to the simplest and least expensive construction is the slab shack shown in floor plan in Fig. 10 and in detail in Figs. 11, 12, 13 and 14. This can be put up in a hurry to serve as a shelter until a more substantial cabin is completed, when it may be used as a rustic garage.

The slabs usually can be had for the hauling if there is a sawmill nearby. The shack is a one-room affair with one single and one double bunk, Fig. 10. A sheet-iron stove, kitchen workbench and shelves complete the furnishings. Although there is no




4 SEASONING LOGS
ROCKS
LOGS STACKED LOOSELY AND SEASONED 8 TO 12 MONTHS
5 PREPARING BARK
FOR DECORATIVE OR INTERIOR USE CUT AND DRY THE BARK
6 FOUNDATIONS, SILLS AND FLOOR JOIST
INVERTED PAN FOR TERMITE PROTECTION
A
CREOSOTED POST
BELOW FROST LINE
ROCK
FLAT ROCKS
CONCRETE
B
SILL LOG
2" X 8"
C
NOTCHED SILL
TRIMMED FLAT ON TOP
8" LOGS SPACED 24" ON CENTERS
D
7 TYPES OF CORNER JOINTS
SPIKE
A
HALF-LAPPED CORNER
EACH LOG NOTCHED HALF WAY THROUGH
B
STAGGERED CONSTRUCTION
TRIMMED FLAT
C
BLIND-NOTCHED CORNER
SECTION
D
THESE JOINTS DRAIN AWAY WATER
E
DOVETAILED CORNER
F
G
BOARDS NAILED TO ENDS OF LOGS
NO NOTCHING REQUIRED
CORNER PIECE
H
TOE NAILED
ROUGH-SQUARED TIMBERS
8 TYPES OF ROOFS
LOG SLABS
ROOFING PAPER
A
2" X 6" PLATE
SHINGLED
B
1" X 6" SHEATHING
ROOFING PAPER
LOG RAFTERS
C
NOTCHED
BARK
1" SHEATHING
9 CAULKING CHINKS
OLD GARDEN HOSE
PLASTER OUTSIDE
MEDIUM CHINK
METAL LATH
PLASTER OUTSIDE FIRST
WIDE CHINK
DRIVE IN OAKUM
NARROW CHINK

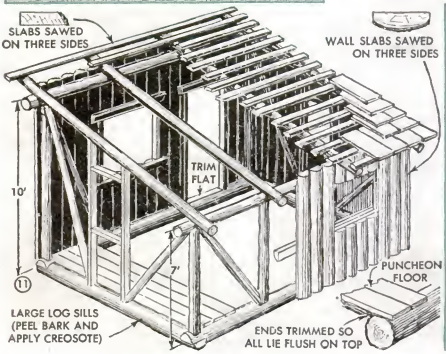


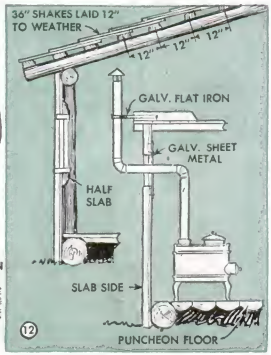


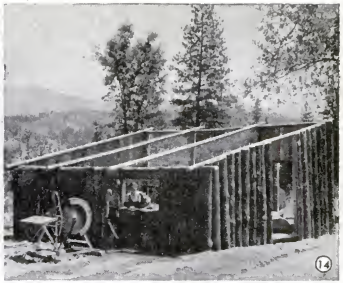
running water or other plumbing, it is much more comfortable and roomy than a tent. It has a puncheon floor, that is, slabs laid with the bark side down directly on the soil. The bottom logs of the walls are creosoted. Stovepipe is carried through a square of galvanized sheet iron nailed over an opening in the wall as in Fig. 12. By ripping the slabs down the center, two straight sides are formed on each, making them useful in building bunks, headers, roof sheathing over log rafters, etc. Canvas is stretched over the bunk frames and tacked along the edges with galvanized roofing nails as in Fig. 10. This makes a bunk more comfortable than an ordinary cot because of the greater width.

General construction is illustrated in Fig. 11. Note how corner posts and log studs are set directly on the sill logs, which should be large in diameter and thoroughly creosoted, as they will be banked with earth inside, and the puncheon floor laid upon the earth. Wall slabs are squared on both edges and extend up to the roof. All corners should be braced diagonally, otherwise this shack might fold up in a high wind, or at least be forced out of plumb. As a slab floor laid directly on the soil will deteriorate in a few years, if you wish the shack to be a more permanent structure leave an air space below and support the floor with a log at right angles mounted on flat rocks midway between the sills.

Typical small log cabin: A conventional design of the small cabin is presented in Figs. 16 and 17. This has a rectangular floor plan, solid log walls, casement windows, slab door and composition roofing. It includes a small cookstove, two swing-up bunks and the usual shelves and kitchen



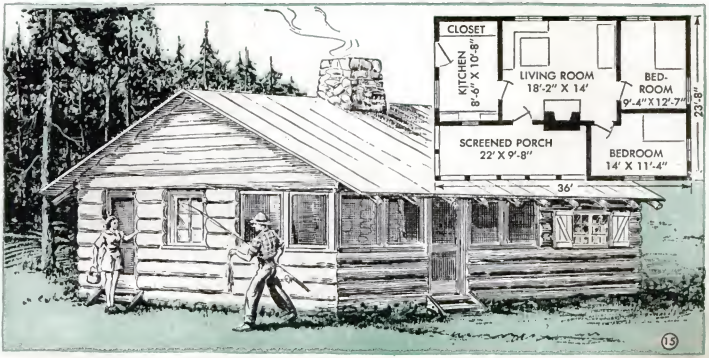




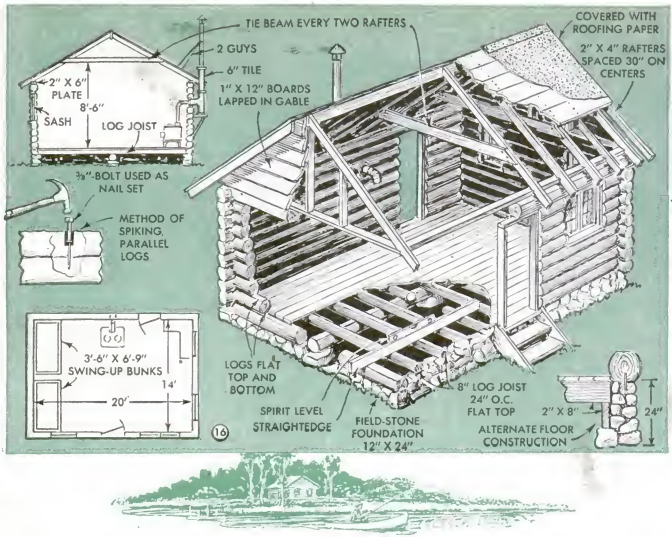
workbench. In the sectional view, note the arrangement of flooring on log joists, which are set into the field-stone foundation. The outside chimney eliminates the fire hazard of a pipe through the roof and also its tendency to leak around the opening. Method of truing up the joists with a center support is shown in the upper left-hand detail, Fig. 16, while alternate construction with dimensioned lumber is shown at the lower right, the sill being supported on a ledge of the foundation wall. Any of the corner joints shown in Fig. 7 will do for the two other corner constructions of the cabin, those detailed at B and D being preferred. The dovetail corner, Fig. 7, E, also is satisfactory. Roof framing in this cabin is standard practice unless the builder prefers one of the special types shown in Fig. 8. This will mean some changes in the roof framing and the slab-sided walls will require regular door and window frames.

Interior details: Slabs make attractive and inexpensive interior walls. They should be assembled with the flat sides together and staggered, those against the 2 by 2-in. strips at top and bottom nailed first, the others nailed to the first row.

Fireplace and chimney: A fireplace is always desirable in a cabin, summer or winter, but unless properly constructed, it will surely smoke. The secret of proper design is to have the narrow throat 8 in. above the opening and the latter not quite as high as its width, Fig. 2. There must be a smoke shelf, as shown in the sectional drawing, to direct down-drafts away from the throat. The flue should be smooth and preferably round to accommodate spiraling gases. Round tile is satisfactory and the area of the cross section of the flue should be 16 sq. in. to every sq. ft. of fireplace opening. Throat area should be no



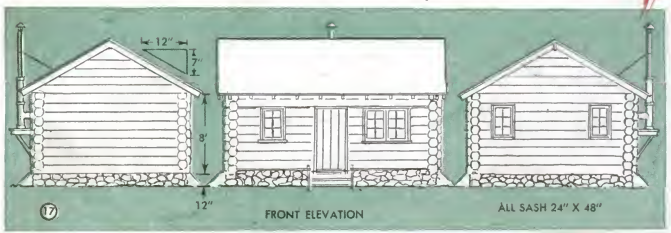
This design, suitable for a hunting or fishing lodge, has a combination living and dining room and bedrooms for modern furnishings. Walls are slab-sided over conventional construction and window framing is regular



less than that of the flue and it should extend the width of the fireplace opening.

Caulking chinks: Openings between the logs are inevitable, no matter how carefully fitted, except in the case of ready-cut log-cabin siding. For medium-width chinks, a length of old garden hose can be temporarily nailed along the seam inside the cabin, fitted in snugly, and plaster applied against it from the outside, making a neat joint when the hose is removed. See Fig. 9. For wider chinks, bend a strip of metal lath to a V-shape and nail it in the chink on the outside. Plaster over this, using a small trowel, and when the plaster has set, finish from the inside. Caulk narrow cracks with oakum and a blunt-nosed chisel.

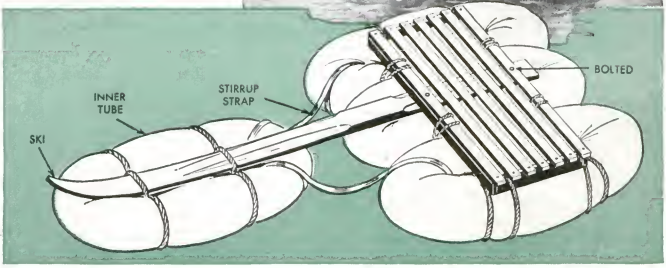
Additional cabins: Based on a rectangular plan, a design for a roomy cabin to accommodate a sizeable family is shown in Fig. 15. This is built of log-cabin siding and construction is pretty much standard. No plumbing is included, except for running water in the kitchen when a source is available. Fig. 1 gives plan and view of a more elaborate cabin with bath and other conveniences, which can be added to as required by extending the bedroom wing.



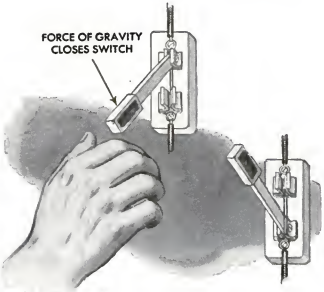
Here's a design that comes about the nearest to being the all-around log-cabin type. Detailed at the top of the page and shown in elevation above, it's cheap to build and can be fitted out for simple living comfort

Improvised Fishing Raft Is Transported Easily

With four inner tubes, some rope, two straps, a ski and a light wooden platform you can improvise a fishing raft that will get you out where the fish are biting. And when you have your catch, it's an easy matter to disassemble the craft and stow it in your car. Three of the inner tubes are lashed together to support the platform that serves as a seat while the fourth is tied to the tip of a ski that serves as a longitudinal member for the raft. The platform is bolted to the ski and can be taken apart for ease in transportation. Although not shown on the drawing, a stabilizing fin attached to the ski at the tip and another at the rear will add to the craft's maneuverability. The two stirrup straps are used as foot rests should the water be a bit chilly. The raft will handle best if a double canoe paddle is used, but a single paddle will do.—Robert F. Sear, Chicago.



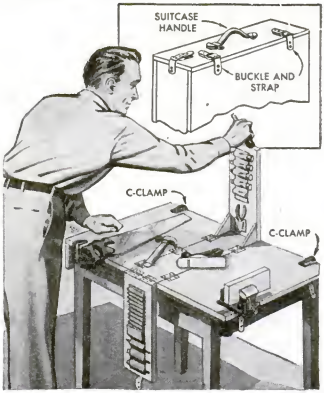
Reversed Knife-Type Switch Will Not Jar Shut



If a knife switch is mounted on a wall in the vertical position, the contacts to which the knife is hinged should be on the bottom. When mounted as shown at the left, the switch may tend to close if the pivot joint of the knife is loose. This undesirable feature is eliminated when the mounting is reversed because if the knife is loose the contacts will hold the switch closed when desired, and when the switch is opened gravity will not cause it to close.

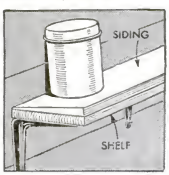
¶The life span of a roof can be lengthened greatly by patching it at the first indication of a stain in the attic.

Tool Case That Fits Over Table Provides Temporary Workbench



Constructed in the shape of a suitcase, this kit is made of wood and held together with hinges, buckles and straps. When opened, one end remains upright and provides a holder for small tools, bits and taps. The other end folds down over the table and has similar accommodations for other tools. The top is removed and the bottom and two sides lie flat on the table to protect its surface. A vise and C-clamps serve to hold the case in place on the table.

Shelf Surface Tilted With Siding Keeps Contents in Place



Jars of bolts and screws that are placed on shelves near power tools often are shaken off the shelf due to vibration of the machinery. If a length of beveled siding is nailed to each shelf with the wide edge outward, any shaking will move the containers back toward the wall.

Ronald Eyrich, Milwaukee, Wis.

Preparing Rawhide From Pelts

To make rawhide from the pelt of an animal, soak the pelt in a pail or tub of water to which a few handfuls of wood ashes have been added. Let it soak for several days, or until the hair comes off easily. Using a dull-edged tool such as a skate blade or the edge of a file, scrape off all the hair so that the pelt is clean. Then turn over the pelt and "flesh" it by scraping off all the fat until it is white and uniform in thickness. During the scraping operation rub in dry sawdust or cornmeal to help absorb the fat. After scraping, stretch the hide and tack it to a flat surface in a shady place away from flies. When thoroughly dry, the hide is softened by rubbing in a mixture consisting of equal parts of tallow and neatsfoot oil. To finish the rawhide, work the skin back and forth over the edge of a board until it is soft and pliable.

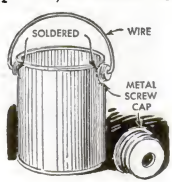
R. A. Jenkins, St. Louis, Mo.

Attractive Flower Pots Are Made Of Tin Cans and Putty

Attractive flower pots for your house plants are made inexpensively by using discarded tin cans, some putty and a little ingenuity. The cans are painted with an oil paint which is allowed to dry. Then a layer of putty is spread over the outside and the surface is worked into rough designs with the hands. After the putty has dried, it is covered with an oil paint and decoratively embellished.

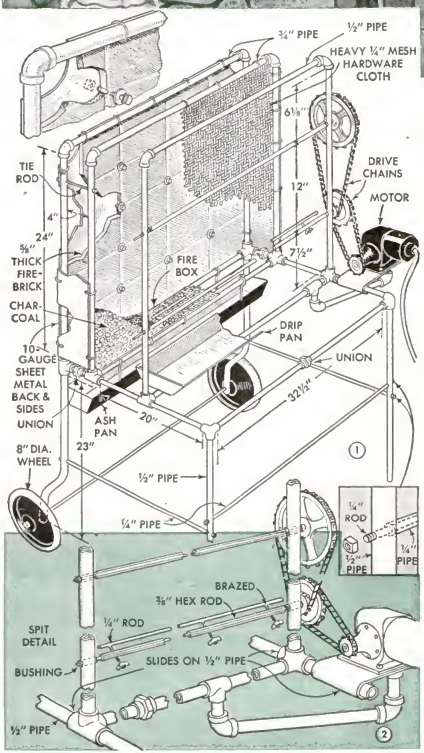
Screw Caps Used to Fasten Bails On Buckets or Cans

Screw caps can be used to attach a bail to a tin can and they also are used to replace broken handles on pails. The metal caps are cleaned and a hole is punched in the center of each cap. Next, the ends of the wire are bent and slipped through the holes in the caps. Then flow a layer of solder on the container and sweat the caps in place.—Richard Verbrugghe, Grosse Pointe Park, Mich.



Reprinted Outdoor Kitchen

Portable Barbecue Pit Has Motor-Driven Spits



By Dorothy A. Brockhoff

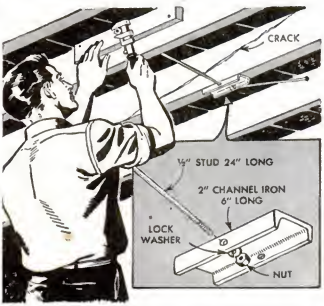
It's not only portable but it's equipped with two electrically driven spits, which is something new in home barbecue stands. The frame is built of pipe and fittings in various sizes as called for in Figs. 1 and 2. A ⅛-in. steel plate, firebrick and a grille or screen of heavy hardware cloth are assembled as shown to form the firebox. Rubber-tired wheels make the unit easy to move about. The motor drive is of the integral gear-reduction type giving about 1½ r.p.m. This can be further reduced by a reduction to the lower spit as will be seen from Figs. 1 and 2. In this particular design the speed of the upper spit is still further reduced by using a larger-diameter sprocket. However, if desired, both spits can be made to rotate at the same speed if sprockets of equal diameter are used. Most any light drive chain and matching sprockets will serve as the drive, which, of course, must be of metal because of the heat from the firebox. Although shown on only one in Fig. 2 each spit should be provided with two meat clamps. Some light brazing will be necessary on this assembly.

Sheet of Aluminum With Handles Makes a Good Griddle

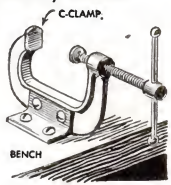
When frying eggs, pancakes and other grilled foods, a sheet of ¼-in. aluminum makes an excellent griddle that will accommodate much more than the ordinary frying pan. The metal is cut to a size that will fit your stove and metal handles are fastened to the ends. Before using the griddle, it should be heated and "burned" with suet. This precaution will keep food from sticking.

Cracked Joist Can Be Reinforced By Channel-Iron Support

Cracked and sagging joists are easily reinforced with a channel-iron support like the one shown. Cut the channel to the proper dimensions and drill a ½-in. hole in the center of each leg equidistant from the ends. Then reinforce the joist on each side of the sagging member with heavy wood strips and drill ½-in. holes through the joists. Hold the channel in place and connect it to the joist on either side with a stud. Tighten until the cracked member no longer sags.—D. E. Horn, River Forest, Ill.



C-Clamp Used to Make a Vise For Small Hobby Work



It's often difficult to work on small parts held in standard vise jaws because the width of the jaws interferes with filing and cutting operations. For this kind of close-in work a vise made from a small C-clamp and a short piece of angle iron is just right. Drill two ¼-in. holes in the C-clamp and four through the angle iron, as shown. Then attach the clamp to the angle and screw the angle to the bench top as indicated.

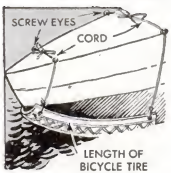
E. J. Wieczorek, Chicago.

Wall Plaque From Cutting Board

For unique kitchen and dinette pictures, use a cutting board of either the small or regular size. Lacquer one side to blend with your color scheme, or, if you prefer, leave the wood in its natural color. Paste on a bright fruit or flower print, shellac the entire surface and hang by the hole that is in the top of the board. These are especially attractive when used in pairs.

Ruth C. Buck, Jackson, Miss.

Bicycle Tire Serves as Boat Guard

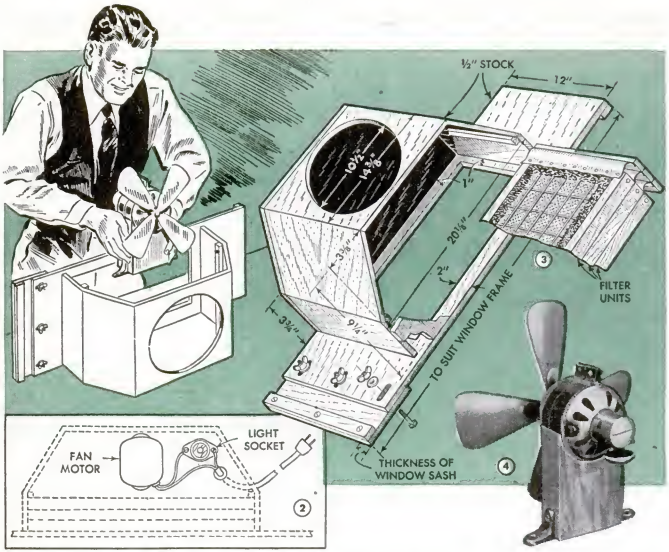


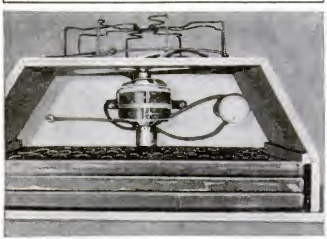
The bow on a kayak and similar frail craft is damaged easily when used in shallow water, where it may strike stones or submerged logs. To prevent this, one boating enthusiast uses a guard made from a length of bicycle tire. The piece is a foot or so long and is punched at each end so that cords, which fasten it to the boat, can be attached. Screw eyes are driven into the deck of the craft and the cords are slipped through these to hold the guard in place.—E. Miller, Linden, N. J.

AIR FILTERS for your windows

NO matter where you live, an open window anywhere in the house lets in all kinds of airborne dust, soot and plant pollens. Homemakers, always beset with the dust problem, and especially hay-fever sufferers and those confined to the sickroom will appreciate these efficient air filters which use filtering units of the spunglass and honeycombed fiber type. They are easily made to fit in any double-hung window. The first type, detailed in Figs. 1 to 4 inclusive, is fitted with an electric fan and three spun-glass filter units of the type used in warm-air heating plants equipped with circulators. The fan is hooded for greater efficiency and is housed in a neat cabinet which projects only a few inches beyond the window stool inside the room. Since the filter units come in standard sizes it's a good idea to have these at hand before you make the cabinet. Width of the filter units must be less than the width of the window. Also, it should be noted that dimensions given in Fig. 3 are only suggestions. They must be altered to suit the window frame and the fan and filter units at hand. The cabinet should be made of material that can be finished to match the woodwork. Birch plywood in ½-in. thickness is a good choice as it can be painted or stained and varnished to match almost any interior finish. However, for a painted finish, ½-in. fir plywood will do very well.

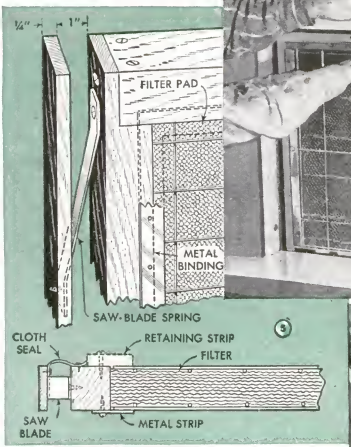
First, measure the window to determine

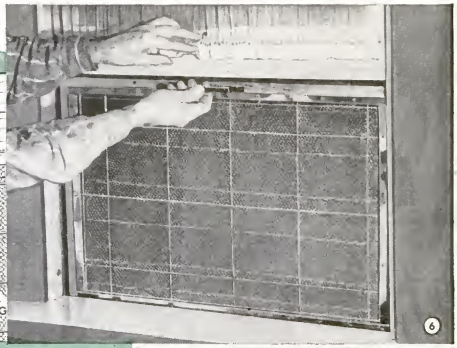


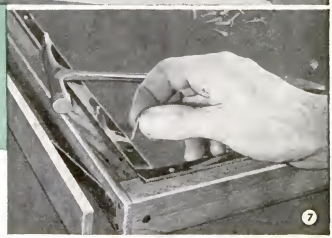


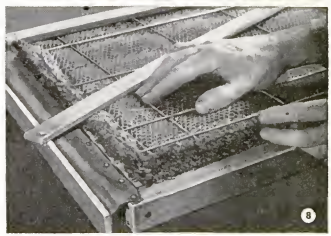
the length of the panel that fits under the raised sash. This measurement should be the same as the width of the lower sash. Note that this panel is made in two parts with a width adjustment so that it can be set in the opening between the inside sash stops and then widened to fit snugly in the sash grooves and against the pulley stiles. The extension piece, Fig. 3, is held in place with three small bolts which pass through slots cut in both members as shown. Wing nuts are used to provide a quick and easy adjustment. The outer ends of both members are built out to the thickness of the sash with cleats so that they fit snugly in the sash grooves. The panel should be about 4 in. wider than the filter unit, and the opening should be about 1 in. smaller each way than the overall size of the unit. This provides a ledge or stop against which the outer unit fits when the cabinet is assembled. See Fig. 3.

Building the five-sided fan housing is mostly a matter of getting the angle joints cut to fit properly. If you don't have a circular saw, the best way to do this is to make the cuts outside the dimension lines with a handsaw and then finish with a plane to a perfect fit. The circular opening in the front member should be about ½ in. larger in diameter than the circle described by the fan blades. The opening can be covered by a fine-meshed wire grille or with the wire guard which is removed from the fan. Usually the guard is just about the right size and makes an attractive finishing detail as well as affording protection from the whirling fan blades. Generally it is necessary to alter the fan unit by removing the regular base and substituting another sawed from hardwood as in Fig. 4. Two sheet-metal compression bands, tightened with stove bolts, are used to hold the motor in place on the wooden base. This is anchored to the bottom of the cabinet with









two small steel angles as indicated. If a heavy rubber band cut from an inner tube is slipped over the motor frame before clamping it in place, the fan will be practically noiseless, and if you want a constant-speed fan to run slower than its normal speed, you can connect a porcelain light socket in the motor circuit as in Fig. 2. A 60-watt lamp in the socket will reduce the speed of a universal-type fan motor sufficiently for the purpose. The completed cabinet should have a snug-fitting cover.

Another type of air filter, detailed in Figs. 5 to 8 inclusive, utilizes the less expensive honeycombed fiber filter unit or pad. This comes in standard sizes, usually 2 by 16 by 20 in., 2 by 16 by 25 in. and 2 by 20 by 20 in. overall. The 25-in. length can be framed to fit nicely in the average window frame. Fig. 5 suggests one way of framing the filter unit so that it will be dust-tight yet can be removed easily. Note in Figs. 5 and 8 that a strip of cloth covers the space between the spring-mounted strips and the frame, thus forming an effective seal. The spring-mounted strip allows the assembled unit to be telescoped slightly so that it can be inserted in the window frame past the inside sash stops. The springs can be made from hacksaw blades, although any flat spring of sufficient strength will do. The inside of the frame is finished with linoleum seam binding as in Fig. 7. The filter unit bears against a retaining strip screwed to the outside of the wood frame as in the lower detail, Fig. 5. A small metal handle attached to the top of the unit aids in removal. Where the unit is left in the window throughout the season it's a good idea to provide a cover to prevent driving rain from entering the filters. A strip of sheet metal screwed to the top member of the frame will serve this purpose. It should be about 4 in. wide and 1 in. shorter than the frame and should be bent down at an angle so that it sheds the water. Paint the metal strip to match the trim color.

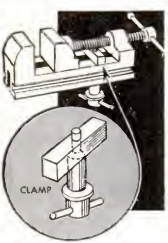
Reflector and Flag Are Warning To Approaching Motorists

If you have a flat tire or your car stalls on the highway, especially on sharp grades and curves, a combination reflector and red flag assembled as shown will serve to warn approaching motorists and prevent collision. Two pieces of lumber of the size indicated in the detail are fitted together with hinges. A screen-door hook is fastened to one side to keep the upright in position. The staff of the flag slips into screw eyes which are on the back of the vertical panel. During the day, the flag serves as warning to approaching motorists and at night the reflector performs the same function.

Joel R. Huffstutter, Fort Riley, Kans.

Vise Is Fastened With Clamp

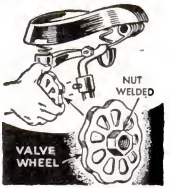
You won't have any trouble keeping a small vise in position on a drill press if it is clamped in place. A simple clamp for this purpose is made as diagrammed in the circular detail. It consists of a bolt turned to shape and threaded at the small end to screw into a small metal bar. This is of a size to slip between the table slot and the guides of the vise. In use, place the vise in the approximate position desired, then slip the clamp up through the table and vise, turn the metal bar crosswise and tighten the bolt. Loosening the bolt a turn or two will permit it to be readjusted as required.



H. W. Holt, San Gabriel, Calif.

Quick Adjustment for Bike Seat

When several people of different heights use the same bicycle, it is necessary to adjust the seat to suit the height of each person. If a sill-cock-handle wheel is welded to the adjustment nut of the seat post, lowering or raising the seat will be an easier task; you won't have to search for a tool and the likelihood of skinned knuckles is avoided.—Andrew Vena, Philadelphia, Pa.



Phone Number on Drifting Boat Helps Locate Owner

One lakeside resort owner who has a number of rowboats for rent paints his telephone number on the transom of each boat. If a boat should be cast adrift or blown out on the lake during a high wind, a person finding it can call the owner on the telephone instead of trying to discover where the resort is located. By this means the boats are located without loss of time.

William E. Davies, Flint, Mich.

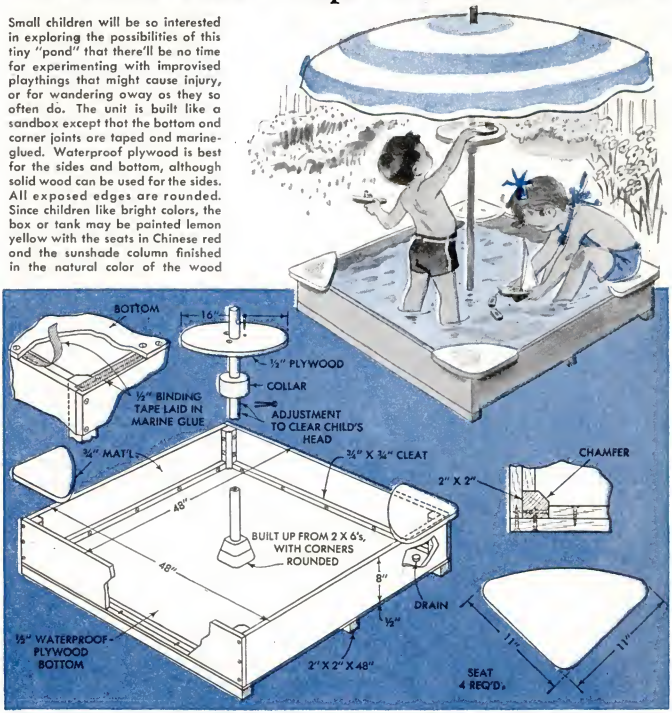
Wind Indicator Yard Ornament Adds Decorative Touch

Here's a wind indicator that is made by using odds and ends found around the house. The base is a discarded floor lamp, which will have to be anchored if not sufficiently weighted to withstand high winds. Sheet aluminum is used for the letters N, S, E and W as well as for the directional arrow. Both the arrow and the anemometer vanes, which indicate wind velocity, are mounted on roller skate wheels so they will turn easily. As the drawing shows, the cups on the anemometer are salad molds welded to light pieces of rod. —C. W. Philpot, Laurens, S. C.

100 W.P.

This Lawn "Lake" Keeps Little Tots in Bounds

Small children will be so interested in exploring the possibilities of this tiny "pond" that there'll be no time for experimenting with improvised playthings that might cause injury, or for wandering away as they so often do. The unit is built like a sandbox except that the bottom and corner joints are taped and marine-glued. Waterproof plywood is best for the sides and bottom, although solid wood can be used for the sides. All exposed edges are rounded. Since children like bright colors, the box or tank may be painted lemon yellow with the seats in Chinese red and the sunshade column finished in the natural color of the wood



Re-Covering Old Card Table Gives It New Lease on Life

Old card tables with worn coverings will take a new lease on life when repainted and re-covered with a bright, new cover. The materials needed are one sq. yd. of leatherette and the same amount of flannel blanket or a similar material. The old covering and padding should be stripped off the table with the aid of a pointed—but not too sharp—tool. Pry the material out of the slot running around the edge of the table; you will find that in most cases there are no nails to hold the cover in place. After this has been done, sand the table with a fine grade of sandpaper, tighten all screws and make certain that all nails on the top surface are countersunk. Repaint the table in either its original color or some color that contrasts well with the new cover. Next, the padding should be placed over the table and pressed into the slot with the rounded end of a bevel gauge or some similar instrument. The leatherette for the top then is placed on the table and trimmed so that it will extend about ¾ in. beyond the slot in all directions. This is fastened in the same way as the padding; in both cases care should be taken to avoid wrinkles and creases.—Lieut. Comdr. John David Howell, West Orange, N. J.

¶If paste is not available, the white of an egg can be used as an adhesive.

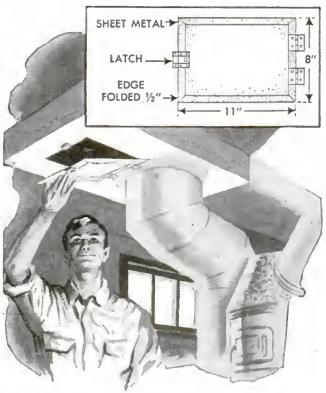
Surface of Fishpond "Skimmed" With Kitchen Broom

To remove dead leaves and insects from the surface of a fishpond or lily pond, an ordinary kitchen broom can be used as illustrated. When the broom is immersed in the water under the material to be removed and then lifted up, the skimmings will adhere to the straws, which allow the water to drain through.

A. H. Waychoff, Phoenix, Ariz.

Clean-Out Door in Cold-Air Duct Provides Easy Access

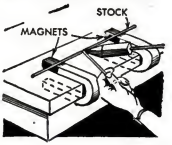
This small clean-out door in the cold-air return of your furnace will provide easy access when removing accumulated dirt.



The opening in the duct should be ½-in. smaller all around than the dimensions given for the door so that the door will overlap the edges to provide a seal and prevent basement air from entering the duct and lessening the recirculating effect of the sealed return. Hinges for the door are soldered or bolted in place and a latch opposite the hinges keeps the door closed.

Thomas J. Mahan, East St. Louis, Ill.

Magnets Used as Soldering Jig



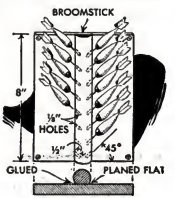
A pair of horseshoe magnets can be used to hold light steel and iron objects in position for soldering. The magnets are slipped over the edge of the work table and the objects to be soldered are laid on the magnets in the proper position. This leaves both hands free and also lessens the possibility of burning the bench.

Paul Criton, Jr., Kayville, Sask., Can.

Substitute for Wood Putty

For an emergency repair, a good substitute for wood putty may be obtained by using collodion cement and wood dust. Using a fairly coarse wood rasp, scour some dust from the underside of the piece to be repaired, or from a similar piece, so that the coloring will match closely. Mix the dust with the cement and when it reaches the right consistency work it into the damaged place. The "fill" should project slightly so that when it dries and shrinks there will still be a raised portion which can be sanded down level with the surrounding surface.—H. G. Kurtz, Columbus, Ohio.

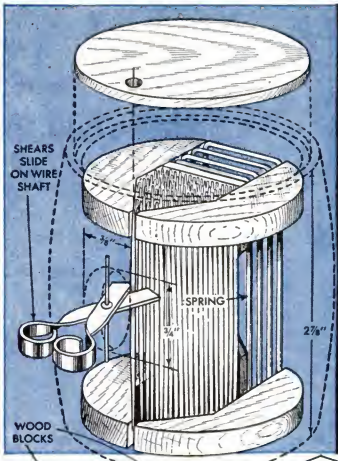
Dart Holder Cut From Broomstick

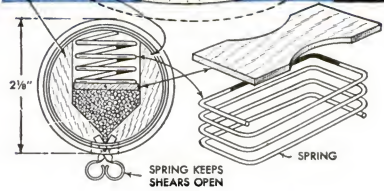


Followers of dart throwing will appreciate this compact holder. An 8-in. length of broomstick is planed so that it can be fastened to a back board. The holes in which the darts fit are ⅛ in. in dia. and ½ in. deep and are spaced on 1-in. centers. They are drilled at an angle of 45 deg. After the holder is sanded and finished, it can be mounted on a wall of the game room.

D. I. Naughton, Mt. Vernon, N. Y.

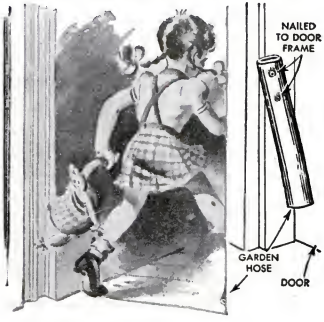
Dispenser Delivers Toothpicks One at a Time





Squeeze the handle, lift up and out pops a toothpick. That's how this dispenser works. It's done by a plunger which reloads the scissorlike handle each time a toothpick is removed. The detail shows how V-shaped pieces, glued at both ends of a turned barrel, form a hopper for the toothpicks. Ends of the barrel are fitted with heads, the top one being removable. A hollow rivet holds the handle together and provides a bushing for a pin which allows it to pivot in an opening in the side of the barrel

Rubber-Hose Bumper Keeps Screen Door From Slamming



To prevent a screen door from slamming, nail 5-in. lengths of garden hose to the door frame so that the free end of the hose will extend out from the frame slightly. This will prevent the door from banging, but at the same time it will permit the door to be closed fully so that it can be locked.

Hi Sibley, Nuevo, Calif.

Rain Kept Out of Ventilators By Fine Mesh Screen

Strong winds will not blow rain through ventilator louvers if the outside of the ventilator is covered with a very fine mesh screen which breaks up the drops and prevents their entering. The screen should be painted to match the ventilator and improve its appearance.

Clarence Breitenfeldt, Marathon, Wis.

"FRAME" *the* PICTURE

Here the scene was viewed from a point to exclude the road and hedge and take advantage of the natural border formed by the overhanging branches. Note how branches and shadow fill empty corners of the picture. Golfers add theme and human interest

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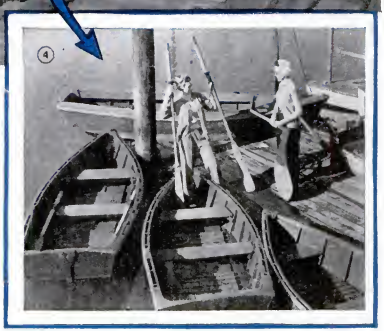
②

Before YOU SHOOT!



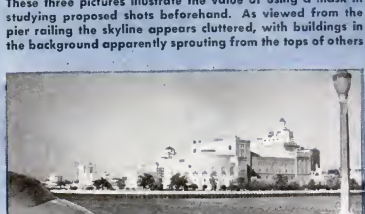
Confining action improves composition without sacrificing theme. Here the interest is centered by selecting a shooting spot which crops the picture of uninteresting background

By Richard W. Emery

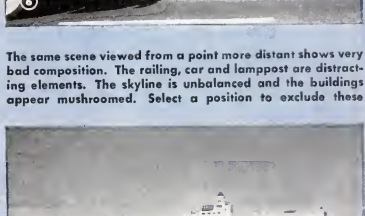
TAILORED shots are yours when you "shoot" in advance through a mask. You pick the spot to take the shot. Framing pictures beforehand can be likened to cropping when enlarging—only here it is done before the picture is ever taken. While it is true that you more-or-less frame the picture when you sight through the camera view finder, the small image makes it difficult to study composition and see all the little things that go to make a good picture something that didn't just happen. Careless handling of composition, such as allowing part of a house in the background when you could have moved to avoid it, getting distracting landscape in a cloud shot, failing to include people or neglecting to let foreground add depth to the picture, can be controlled to a great extent by viewing the scene first through a simple cardboard mask. Holding the mask close to the face and looking through it with one eye enables you to see the finished print, so to speak, and to study the proposed shot carefully from the standpoint of composition and shooting angle. Primarily it's a case of viewing the scene from many angles and distances until a vantage or shooting point is found that will produce the picture you want. To get the most out of the mask, you should know for sure if the camera "sees" the same amount of area as seen through the view finder. You can determine this by making a few test shots at various depths of field and noting

Photographs by Ray Chapin

These three pictures illustrate the value of using a mask in studying proposed shots beforehand. As viewed from the pier railing the skyline appears cluttered, with buildings in the background apparently sprouting from the tops of others



The same scene viewed from a point more distant shows very bad composition. The railing, car and lamppost are distracting elements. The skyline is unbalanced and the buildings appear mushroomed. Select a position to exclude these



Changing the position and viewing the scene from different angles produced this well balanced and defined picture. The skyline is uncluttered and the water, unbroken by distracting objects, adds depth and quality to the picture

Check these points for good composition:

1. General pictorial qualities
2. Theme
3. Lighting (shadow masses and high lights)
4. Background, foreground and sky
5. People
6. Focal point
7. Color and exposure

whether or not the width of vision is equal to that recorded on the film.

Figs. 1, 2, 3 and 4 are good examples of what framing will do to improve composition. By eliminating the road and hedge in Fig. 2 and allowing the tree and its shadow to fill empty areas, the resulting picture in Fig. 1 is interesting and has depth. The introduction of people, in this case golfers, adds human interest and gives the picture a definite theme. The same is true in Fig. 4. By "cropping" the typical boat scene in Fig. 3 of distracting and uninteresting elements, the result is dynamic and uncluttered.

All you need for a mask is a piece of dark cardboard about 12 in. square with an opening cut in the center equal to the size of negative or picture that is to be taken. For example, if your camera takes No. 120 or 620 film, the opening in the mask should measure 2¼ by 3¼ in.; if No. 116 film is used, the opening should be 2½ by 4¼ in., etc. Larger openings, such as 5 by 7 in. and 8 by 10 in., require a mask having a margin sufficient to block off vision of surrounding area. Vertical and horizontal crosslines, which will aid in centering the subject, can be attached to the opening in the manner detailed in Fig. 10. Not only will the mask allow you to view the scene full size but also right side up, which is a distinct advantage when using a camera having a ground glass.

In locating the best shooting point you should consider a number of factors, such as general pictorial qualities or composition, theme, lighting (shadow masses and high lights), background, foreground and

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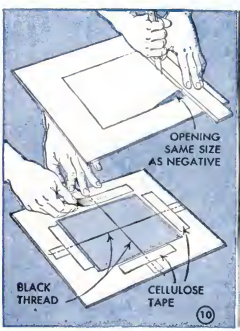
A mask is helpful in arranging compact composition in close-up shots as shown in the views above and below. Viewing the picture directly above from a point closer will fill empty corners and give better composition. Viewing shots beforehand will eliminate waste space and permit greater detail to be had

sky. In most instances, people in the scene will mean the difference between just another snapshot and one that is outstanding. Select a view that is free of objects that tend to distract from the central subject. An example of how such objects can rob a picture of good composition is shown in Figs. 5, 6 and 7. Shooting the skyline from the railing as shown in Fig. 5 produced the shot shown in Fig. 7, which is far better pictorially than the view in Fig. 6, taken from a more distant position. Not only do the railing, car and lamppost detract from the central subject, but the skyline is cluttered by buildings appearing to be sprouting from the tops of others. A shift in the camera angle corrected this, as you see in Fig. 7. Study your scenes with the mask held one way and then the other to see if the picture would be better taken vertically instead of horizontally or vice versa. Also, view the scene from different angles to see if a change of position will improve composition. Don't be satisfied with the easiest way out; the picture you want may require shooting from a roof top or tree.

Knowing your camera field and working close-in for shots such as those in Figs. 8, 9 and 11 adds punch to your pictures. Here you can see how a mask will aid in arranging compact composition. Fig. 8 could be improved further by allowing the shells to fill empty corners of the picture or by taking a position somewhat nearer. When



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How shooting close-up and from a different angle improves composition is shown in these two shots of an old Spanish mission. In the picture at the left the photographer was able to balance general composition nicely with shadow masses covering the arch, but the same shot taken close-up from a different position produced a more pleasing picture of compact arrangement which confines the theme to a central point of interest as shown below

parallel lines run in line with the camera, you must allow for the foreshortening effect of the lens. Continued use of the mask soon will sharpen your eye to recognize good composition, and you'll become aware of the fact that a picture is not all center but has edges too. Figs. 12 and 13 show how an archway can be used to form a natural frame for the picture by shooting through the arch. Notice, too, in Fig. 12 how shadows covering the face of the arch balance the general composition of the picture. Comparing the two pictures you will see in Fig. 13 how a change of shooting angle produced compact arrangement without robbing the picture of its general theme. Narrowing the field of vision to the portion indicated in Fig. 14 shows how composition is improved without sacrificing theme. Selecting a shooting spot near the subject naturally increases detail and permits greater enlargement.

For your first effort in using the mask, pick a subject that is stationary, such as a landscape or a lake scene. If you have a definite theme in mind—trees, distant shoreline with perhaps a hilltop against the skyline—start prospecting for these "props" with your mask. Locations that look good to the eye are not always good pictorially when viewed through the mask. By imagining that you are looking at the finished print you can determine easily if composition will be improved any by raising the mask to include the skyline in the upper third of the picture. Or perhaps it will be still better if you swing to one side

Here's a good example of how narrowing the field of vision improves composition without sacrificing the theme of the picture. The area in the margin of the mask (shown transparent for the sake of illustration) is unimportant and detracts from the central subject

Right: This picture of a girl in a beach costume illustrates how theme is planned by careful use of minor elements expressing the same idea. The girl is the major element, but her costume, the pier planking and railing, the breaking waves and the hotels in the background all express the idea of beach and vacation. Studying a picture from various angles helps to establish harmony between major and minor elements so that they tell the same story

a little to have an overhanging branch or other object fill an empty spot in the picture or to provide a natural frame.

Fig. 15 illustrates how minor elements can be used to emphasize theme in a picture. The girl in the swimming costume alone conveys the thought of vacation and beach fun. But by introducing minor elements, such as the railing, pier, waves and hotels, the theme is accentuated. However, unless careful thought is used, minor elements can kill the main idea of the picture by having no direct relation to the main or major element. Studying a picture through a mask before shooting helps to establish harmony so that both elements tell the same story. Building up the composition in a picture requires a systematic routine of considering each point individually and checking it with the mask. Where a shot is planned to include a person or a group, select the location first, choosing a background that will contrast well with the color of the clothing, then concentrate on placing the subjects to best advantage within the area confined by the mask.

Inner-Tube Band on Tripod Legs Makes Compact Bundle

To keep the legs of an old camera tripod from spreading when you're carrying it, snap a 2-in. band cut from an inner tube around the ends as shown. The rubber band holds the ends in place so that the tripod may be carried easily. If the band is large, it may be looped over the legs several times, as indicated in the circular detail.—Duke D'Ambra, Lawrence, Kans.

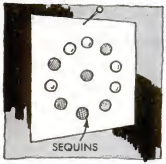
Color Filter Made From Key Tag

A satisfactory and inexpensive color filter can be made by substituting a disk of colored Cellophane for the cardboard disk in a metal-rimmed key tag. To hold the paper in place, apply a little colorless nail polish around the rim and allow it to thicken. Then flatten the rim in a vise. Holding the filter in a draft of warm air will draw the Cellophane taut after the cement has dried. If the right size tags are used, they will fit many filter adapters. To clean the filter, wipe it gently with a soft, dry cloth.

Typewriter Eraser Brush Is Used To Clean Camera

A worn typewriter eraser of the kind shown takes little room in a camera case but is handy when used to brush away dust that accumulates in hard-to-reach corners of a camera. However, the brush should never be used to clean the lens, filters, viewers or range finders.

Focusing Card Aid for Dim Light



To overcome the difficulty of focusing a camera in dim light, use a card on which a few colored sequins have been glued. These small disks have high reflecting power and are easily seen on the ground-glass screen. The card should be placed on or slightly to one side of the subject to obtain the best results.

Ferrotype Tins Held in Drawer

If ferrotype tins are held in a curved position while photoprints are drying on them, the prints will be less likely to curl. A length of string or wire often is used to hold the tins in the curved position, but I have discovered another method. I place my tins in one of the small drawers in my buffet. An added advantage to this arrangement is that when the prints dry and fall off, they drop into the drawer where they are gathered easily.

William Swallow, Brooklyn, N. Y.

Data Recorded on Negative When Exposing Film

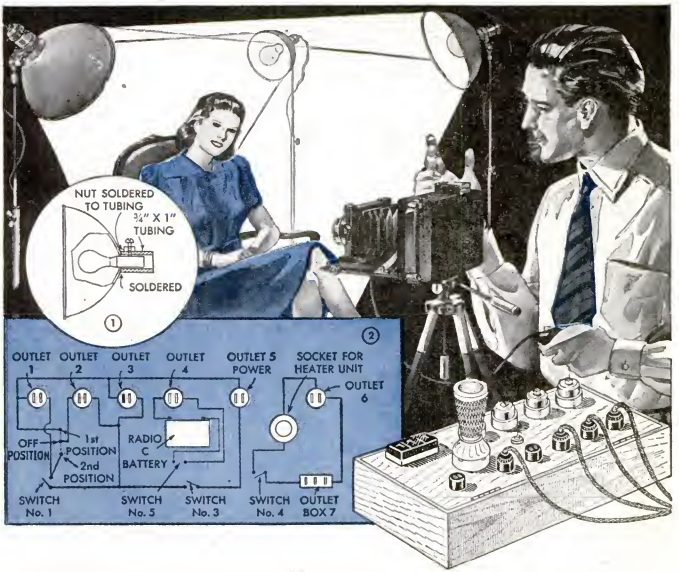
Owners of cameras using cut film and plate holders can record information on the negative at each exposure. A strip of clear celluloid is cut to fit in the back of the camera at the bottom as indicated. The information is written or printed on the strip with a black marking pencil. When the film is exposed the information is recorded at the top of the picture. The celluloid is cleaned easily with a dry cloth. This method is most effective for outdoor scenes which include the sky.

Accurate Weighing of Chemicals

By controlling the flow of photographic chemicals from wide-mouth bottles onto the scale pan, weighing can be done more accurately; none will be spilled and it will not be necessary to return any of the chemical to the bottle. To do this hold a card over the bottle mouth so the flow will be uniform at all times.

LLB # 119

Control Unit Gives Wide Range in Photo Lighting



WITH this multiple-outlet unit you can control photo lamps for focusing, flash and flood lighting from one control panel. The unit consists of a battery of outlets and switches conveniently arranged on the cover or lid of a small wooden box of suitable size and depth to house the wiring and connections. The box lid serves as a panel on which the switches, plugs and a socket for a 600-watt porcelain heater unit are mounted. The box should be made from ½-in. hardwood.

Six-volt focusing and flash: Reflectors from 1937 Ford headlights are altered as in Fig. 1 by soldering a ¾-in. length of copper tubing to the back of the reflector in the position shown. A setscrew and nut hold the midget bulb adapter in place. By moving the adapter back and forth the light can be focused for both spot and flood. As many as six reflectors can be used. To operate, turn heater unit into the socket and plug the 110-volt line into outlet No. 6, Fig. 2. Plug reflectors, with 32-candle-power headlight bulbs, into outlet No. 7. Turn on switch No. 4 to focus and arrange lights. Turn off switch No. 4 and substitute midget flash bulbs. When switch No. 4 is turned on, bulbs will flash.

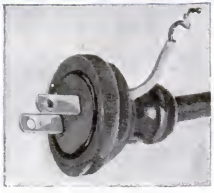
Floodlight: Plug 110-volt line into outlet No. 5 and plug floodlights into outlets Nos. 1 and 2. Then turn off switch No. 1 and turn switch No. 2—designated by 1st, 2nd and off positions in Fig. 2—to the second position which dims the lights for focusing. Turn on switch No. 1 and turn No. 2 to the first position for bright.

Flash on floodlight circuit: Turn off switches Nos. 1, 2 and 3 and plug the 110-volt line into outlet No. 5. Turn on switch No. 3 and plug lights into No. 3 outlet and focus. Then turn off switch No. 3 and remove flood lamps from outlet No. 3 and replace with flash bulbs. Turn on switch No. 3 and bulbs will flash.

Battery flash: Outlet No. 4 is connected to a 6½-volt radio C battery and by plugging into this outlet with flash bulbs and closing switch No. 5, the bulbs will flash. You can use any voltage C battery and flash any reasonable number of bulbs.

CRAFT QUIZ

1. He is using a—
(a) Hand drill (c) Ratchet drill
(b) Brace (d) Post drill



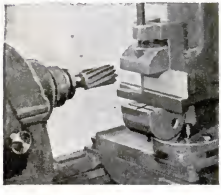
2. Extra wire on this plug is for—
(a) Three phase (c) Better contact
(b) Ground (d) Special motor

3. Plain to see, this wood is—
(a) Dappled (c) Quilted
(b) Mottled (d) Flake figure

4. Wrong in this picture is—
(a) Hands (c) Size
(b) Jaw opening (d) Handles

5. He works in a—
(a) Pattern shop (c) Foundry
(b) Gear shop (d) Cabinet shop

6. Interior panels in this trailer are—
(a) No. 2 Common (c) Holly
(b) Birch (d) Hemlock



7. Cutting tool here is—
(a) Spiral reamer (c) End mill
(b) Broach (d) Skiving tool

8. He hopes to be—
(a) On the 59 (c) At the gate
(b) On tap (d) Swaging

9. This worker is—
(a) Stenciling (c) Offset printing
(b) Silk screening (d) Block printing

ANSWERS: 1—a; 2—b; 3—a; 4—a (for proper balance, right hand must grasp end spindle of handscrew); 5—a; 6—b; 7—a; 8—a (referring to point angle of drill); 9—b; 10—a (cup center is used only for wood turning); 11—c

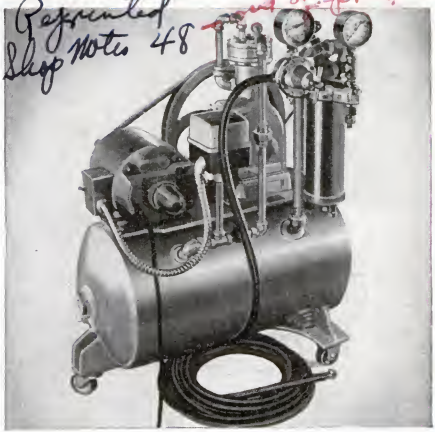
10. Getting ready to—
(a) Turn wood (c) Taper
(b) Turn metal (d) Use faceplate

11. Metal used here is—
(a) Cast iron (c) Wrought iron
(b) Foundry pig (d) Point 95 carbon

Farm Manual

Shop Notes

Reprinted Shop Notes 48 — out of print



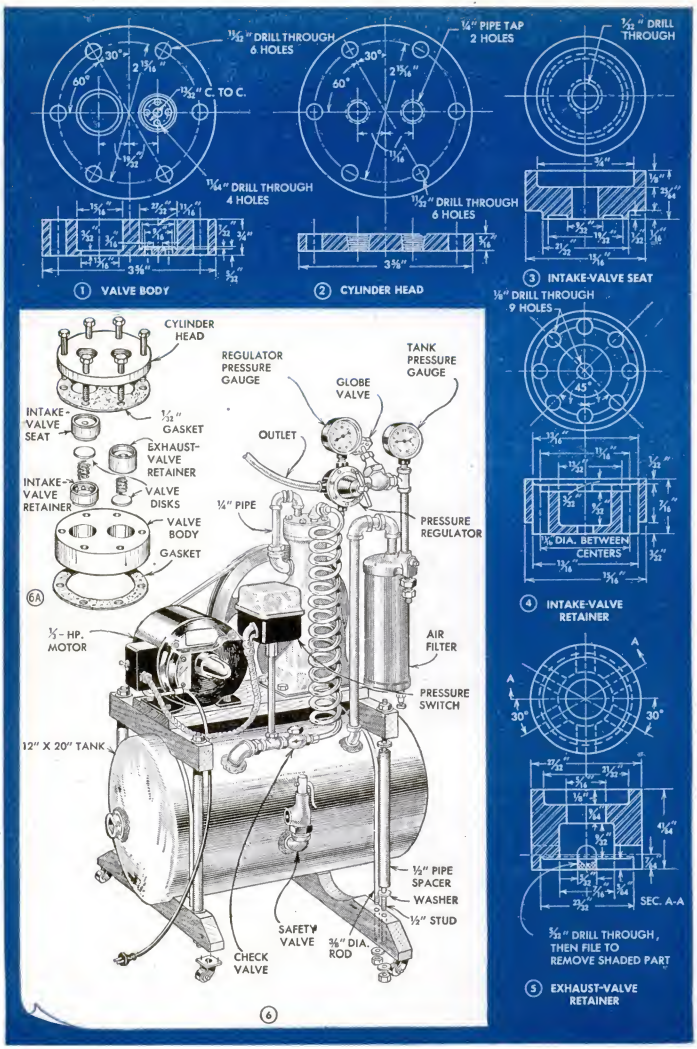
Build Your Own Air Compressor

Homeowners, farmers and small business contractors will find this highly efficient air compressor a time and labor-saving device

By Arthur Youngquist

HERE is an air compressor that anyone can make inexpensively as it utilizes an old household refrigerator compressor of the piston type. It will handle any job requiring up to 65 lbs. per sq. in. pressure, such as paint spraying, sand blasting, air-blast cleaning, running portable pneumatic tools, etc.

Building a machine of this type is principally a job of assembling various purchased parts. However, some machine work will be necessary if the compressor unit is of the type that has the valve in the piston. If the valve is in the compressor head, the valve mechanism may be used without change. The compressor used in this unit is the valve-in-piston type. To convert it for use as an air compressor, the cylinder head and piston are removed and all the valve parts taken out of the piston. The valve hole is closed with a solid pipe plug and faced off flush with the top of the piston, which then is re-installed. A new valve body, cylinder head and valve retainers, as detailed in Figs. 1 to 5 inclusive, are turned from cold-rolled steel to hold the original flipper valve disks and valve springs. Care should be taken to provide smooth finished surfaces



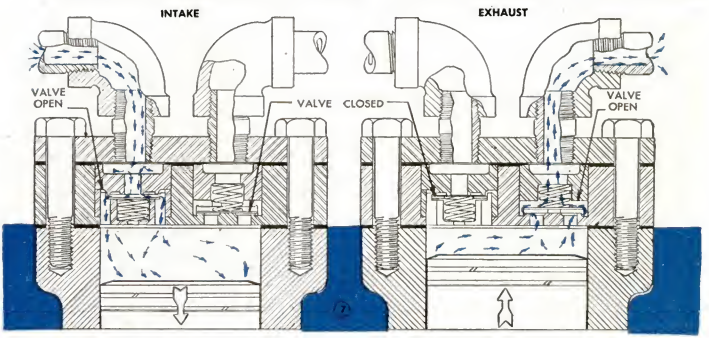
15/32" DRILL THROUGH 6 HOLES
30°
60°
2 15/16"
13/32" C. TO C.
19/32"
11/64" DRILL THROUGH 4 HOLES
15/16"
27/32"
11/16"
3/32"
3/16"
9/16"
1/32"
3/4"
13/16"
3 5/8"
5/32"
1 VALVE BODY
1/4" PIPE TAP 2 HOLES
30°
60°
2 15/16"
11/16"
11/32" DRILL THROUGH 6 HOLES
9/16"
3 5/8"
2 CYLINDER HEAD
7/32" DRILL THROUGH
3/4"
1/8"
25/64"
9/32"
19/32"
1/32"
1/16"
21/32"
15/16"
3 INTAKE-VALVE SEAT
1/8" DRILL THROUGH 9 HOLES
45°
13/16"
11/16"
13/32"
1/32"
3/32"
9/32"
7/16"
1 1/16 DIA. BETWEEN CENTERS
3/32"
13/16"
15/16"
4 INTAKE-VALVE RETAINER
A
A
30°
30°
27/32"
21/32"
5/16"
1/8"
9/64"
41/64"
9/32"
7/64"
5/32"
7/16"
3/64"
23/32"
SEC. A-A
5/32" DRILL THROUGH, THEN FILE TO REMOVE SHADED PART
5 EXHAUST-VALVE RETAINER
CYLINDER HEAD
INTAKE-VALVE SEAT
1/32" GASKET
EXHAUST-VALVE RETAINER
INTAKE-VALVE RETAINER
VALVE DISKS
VALVE BODY
GASKET
6A
REGULATOR PRESSURE GAUGE
GLOBE VALVE
TANK PRESSURE GAUGE
OUTLET
1/4" PIPE
PRESSURE REGULATOR
1/3-HP. MOTOR
AIR FILTER
PRESSURE SWITCH
12" X 20" TANK
1/2" PIPE SPACER
WASHER
1/2" STUD
SAFETY VALVE
3/8" DIA. ROD
CHECK VALVE
6

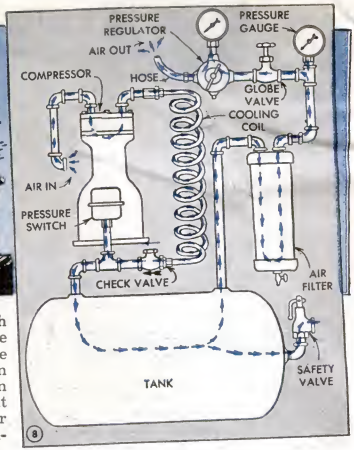
for the valve disks to seat against. Note in Fig. 3 how two narrow surfaces or rings are turned on the valve seat to contact the valve. These narrow surfaces provide better seals than one wide surface, and the center ring helps to prevent the valve disk from buckling under the increased pressure to which the compressor will be subjected. Two gaskets and longer head bolts complete the valve change-over. The parts are assembled as shown in the exploded view, Fig. 6A, and bolted to the compressor. The valve retainers are dimensioned to provide a 1/64-in. projection above the top surface of the valve body to assure an airtight seal and keep the retainers snug against the valve body. Fig. 7 illustrates how these valves operate on the intake and exhaust strokes. A pressure of 65 lbs. per sq. in. was obtained with a 1/3-hp. motor operating the compressor at about 550 to 600 r.p.m.

VARIABLE AIR REGULATOR CONTROLS PRESSURE FOR A WIDE VARIETY OF USES

If your compressor unit is of a different make or model than the one shown, carefully measure the length of the valve springs as assembled in the piston and make the new valve head accordingly. This is important, as the strength of these springs has been calculated carefully by the manufacturer, and their compression in the new head must be the same as it was in the original installation.

When purchasing the tank be sure that it conforms to the American Society of Mechanical Engineers code for unfired pressure vessels of 150 lbs. per sq. in. In mounting the machine shown in the photographs a welded steel base and mounting plate were used. However, for those who do not have access to welding and cutting equipment, the arrangement shown in Fig. 6 will hold the parts equally as well. Two 3/8-in.-dia. rods threaded on both ends encircle the tank and anchor it to the lower cross members. The four pipe spacers all should be the same length and slightly undersize so the cross members will clamp the tank securely. The motor and compressor then are mounted on the baseboard which is bolted to the upper cross members. The compressor intake is piped with a 90-deg. elbow turned toward the cylinder wall as indicated in Figs. 6 and 8 to prevent clothing or hands coming in contact with the intake opening when the machine is running. Although not shown in the photos, the input line to the tank should be of high-pressure tubing coiled as shown in Fig. 6. This will cool the air before it reaches the tank and avoid fracture of the line due to vibration. A check valve permits air to pass through in the direction indicated by the arrows in Figs. 6 and 8 and prevents



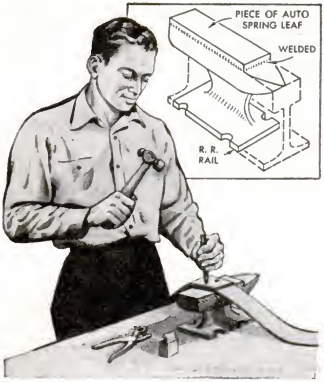


the air in the tank from escaping through the compressor when it is not running. The adjustable pressure switch shuts off the motor when the desired pressure has been reached. A safety valve is a must and can be connected to the tank at any convenient outlet. If the compressor is to be used for paint spraying, an air filter should be installed in the outlet line to remove any water, oil or dirt that would contaminate the paint. A pressure gauge, globe valve and air regulator with pressure gauge then is fitted to the outlet line. All of the parts are standard and may be purchased in whatever types and sizes are needed to suit the requirements of the builder.

The piping arrangement shown in Fig. 6 need not necessarily be followed; however, it is important that the relative position of the various parts be similar to that indicated in Fig. 8.

As a safety measure when the compressor and air-driven equipment are not in use, close the globe valve, loosen the thumbscrew of the pressure regulator and drain off the air in the line until the gauge on the regulator drops to zero.

Shop Anvil From Railroad Rail Will Handle Light Work



One mechanic finds a small steel anvil cut from a piece of railroad rail one of the most useful tools in his shop. The rail is cut with a torch along the solid lines as shown in the drawing. A piece of auto spring leaf is welded to the top to secure a flat surface that is harder than rail steel. To weld, use an austenitic stainless-steel, or similar, rod. Being small, the anvil is moved about the shop easily.

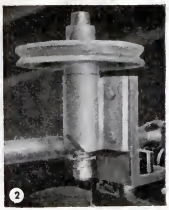
Phillip Wilson, Streator, Ill.

Two-Sided Brush for Mechanics

By securely tying two toothbrushes back to back, an efficient brush for mechanics can be made. Since the bristles of a toothbrush are stiff, this brush is excellent for cleaning keyways, gears, etc., in milling machines, lathes and other machinery. The fact that the brush has two sides makes it useful for cleaning the inside of bored shafts, counterbores and inside threads.

Henry S. Galus, New Bedford, Mass.

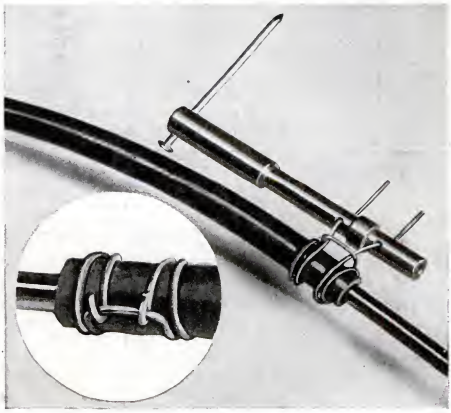
Shopmade Milling Attachment Fits Any Lathe



When the amount of milling work in a small shop does not justify investment in an expensive milling attachment, this homemade one for a lathe will prove satisfactory. It has been used successfully in various gear-cutting operations as well as for regular milling work. The attachment consists of a heavy angle casting, a cast bearing and a spindle. The angle casting is drilled on the lower side to fit the lathe tool post and on the vertical side to take four bolts, which attach the bearing. A pulley is keyed to the upper end of the spindle, the lower end of which is threaded to take various cutters. An angle bracket bolted to the lathe carriage at the rear carries a motor which drives the spindle. Figs. 1 and 2 show general construction. The type of lathe will determine the size of the parts used. The tool post provides horizontal movement, and shims inserted beneath the attachment vary the height. Collars of various thicknesses above or below the cutters will serve the same purpose.

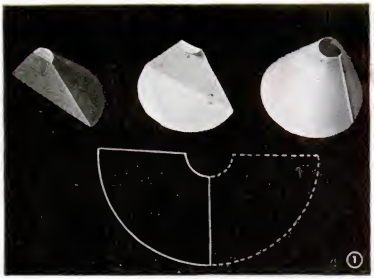
Bending Tool Forms Wire Clamp Around Rubber Hose

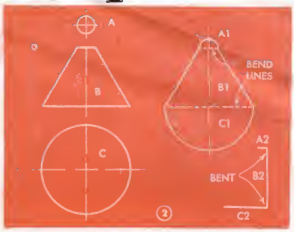
A tool to form neat wire clamps around rubber hose is made easily from a short length of ⅝-in. drill rod. The rod is turned and three holes are drilled in it as illustrated, the size of the holes being determined by the size of the wire. To use the tool, bend the wire double and wrap it around the hose twice. Then insert the ends under the doubled end and in the holes in the tool. Draw the clamp tight, using a spike for added leverage, turn the ends over and cut off the excess length. A finished clamp, which fastens a piece of hose to metal tubing, is shown in the circular detail.—Benj. Neilson, Aurora, Nebr.



Booklet: "Short Method of Pattern Development" 30

Simplified





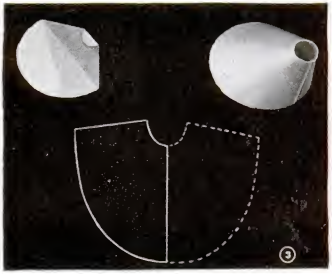
Known as the "rollation" method, this trick-of-the-trade short-cut, developed by Ralph W. Poe, Canton, Ill., is a time-saver in laying out accurate sheet-metal patterns. Detailed knowledge of geometry or drafting is not required

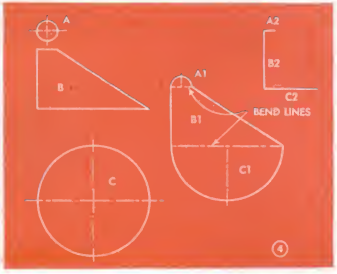
By Charles T. Pearson

WHILE not entirely new to the trade, this simplified method of laying out sheet-metal patterns without an exhaustive knowledge of mathematics will be of value to the home owner who may undertake installing his own furnace duct work and similar sheet-metal jobs. It's a case of visualizing a sheet-metal form as being the surfaces of a solid, and making a metal template to duplicate on paper the exact outline of the shape simply by rotating it in the manner shown in Fig. 7.

Round-to-round transition: The basic principle of the method is explained in Fig. 1, which compares a sheet-metal cone, as an example, to an identical solid one of wood sliced exactly in half. By rotating one of the halves over a piece of paper and tracing the outline of its edges, you have an accurate pattern of half the cone. Two of these half patterns, one being reversed and matched edgewise as indicated by the dotted line in the diagram, comprise the complete pattern, exclusive, of course, of allowance for seams. In actual use, a metal template is substituted for the wooden form and is chalked as in Fig. 6 and rolled over a piece of black paper to transfer its contour. The use of carbon paper, Fig. 7, provides another way of making an impression. Ink and paint can be used, too.

Determining the shape of the template is very easy, and the method given in Fig. 2 for laying out a cone (round-to-round transition) applies to all fittings regardless of shape. Referring to Fig. 2, B represents the side view or cross section. The circles above and below it, A and C, correspond to the diameter of the small and large ends. As only half of the cone is required to form the pattern, only half of diameters A and C are drawn. Scribe B first, full size, and then add A and C to each end as shown. Lay out the template on 24 or 26-ga. metal and cut it out carefully as in Fig. 5. The template is completed except for bending the ends A1 and C1 at right angles to B1, Fig. 2. It is important to bend these exactly 90 de-





from Market Dept. Division American Rolling Mill Company, Middletown, Ohio

SHEET-METAL LAYOUT

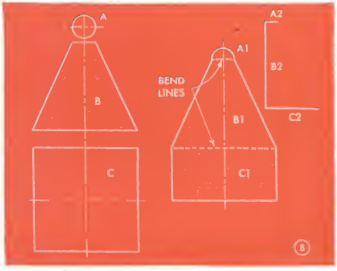
(5) CUT ACCURATELY, THEN (6) APPLY CHALK TO EDGES (7) OR USE CARBON PAPER

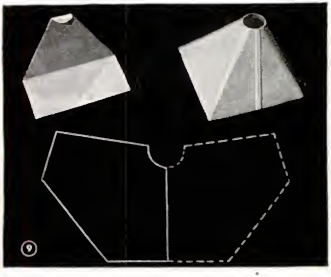
grees, A2 and C2, to insure an accurate pattern. Any deviation from a right angle will produce a corresponding irregularity in the actual pattern. Where the template is quite large, the ends should be braced with a wooden spacer or made rigid by metal braces soldered in place. The completed template should look like the one shown at top center in Fig. 1.

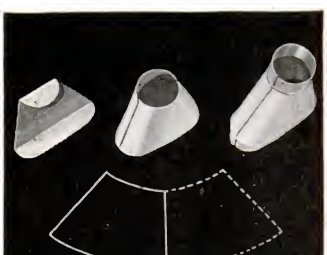
Figs. 3 and 4 give another similar example of a round-to-round (off-center) fitting where one side is at a right angle to the large end and thereby requiring an irregular pattern. Here you proceed practically the same as before. What the template actually looks like can be seen at the upper left in Fig. 3, and also the shape of the pattern it will form. The solid line represents the first pattern, the dotted one being the same pattern reversed. Remember that the pattern as it is does not allow for seams. Fig. 4 shows how the template is laid out, and by comparing it with Fig. 2 you can note readily how the two differ. Oval-to-oval fittings are laid out in the same manner.

Square-to-round transition: The square-to-round (funnel-type) fitting in Fig. 9 is a common one encountered in most duct work and similar installations, and as a rule is a difficult item to form, especially by conventional cut-and-try methods. The template required is a very simple one. Fig. 8 gives the steps to follow in making it, which here again follow the same fundamental principle as before. The diameter of the small end is seen at A, the cross section at B and the large end at C. Where a fitting as large as a stove hood or a hopper is to be made, it is obvious that the template will have to be braced to keep the ends rigid and at right angles while rolling the pattern. The pattern is formed by the same process as before, coating the edges first with chalk or ink. In rolling the template you must be careful to hold it firmly and not allow it to shift during the operation.

Oval-to-round transition: Oval-to-round fittings, Fig. 10, frequently are required to connect the oval collar on a furnace to the round smoke pipe, and generally there is quite a difference in the size of the two ends. While such a fitting is ordinarily difficult to lay out, this method makes it quite simple. Fig. 11 gives the shape of the template pattern required. You'll notice that it amounts to just another funnel pattern,







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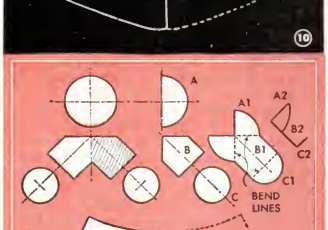

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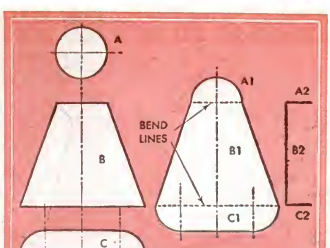

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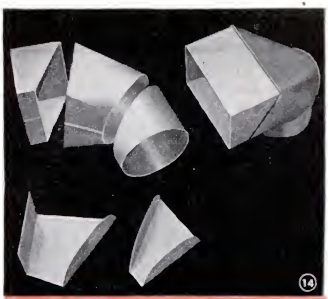
differing only in that C, in this particular case, is oval instead of round. Affixing collars, which is simply a case of adding bands, is done after the fitting is formed.

Y-fitting: Here you have what is called a multi-section transition. Fig. 13 shows the odd shape of the template required to produce the pattern for an ordinary Y-type fitting. First you must visualize the fitting and lay it out on paper according to the drawing at the upper left in Fig. 12. The cross sections B are purposely tapered slightly to facilitate installing and also to aid in joining the two parts together. Both branches of the fitting are identical and therefore only one template is required. Going through the steps as before, one section (shown shaded) is laid out full size. The half circle, A, establishes the size and shape of the top opening of each branch, while C is the shape of the small opening. Half the diameter of C is added to B1, as before and the half circle, A, is added in two quarter segments as shown at A1. After this, the ends are bent 90 degrees. The pattern produced by the template is symmetrical and need not be reversed when drawing the full pattern. In providing for seams, make allowance on the original pattern, then in cutting make a second allowance for joining the two branches.

Square-to-round elbow: Another multi-section fitting is the elbow shown in Fig. 14. This type of fitting is commonly used in gravity furnace leads where a rectangular-to-round transition is required to connect cold-air registers. Such elbows are generally made up of three or more sections. The cross section of the complete elbow, parts X, Y and Z, is shown at the upper left in Fig. 15, with the size and shape of the connecting runs indicated by the rectangle and the circle projected at the top and bottom. Section X requires no template to make its pattern; it is laid out according to the diagram to equal the size of the projected rectangle.

The shaded section, Y, is laid out to correspond with A, B and C, A and C being identical in size and shape with the openings of the finished piece. Half of A and C are joined to B1 and the template is cut and bent as before. Note that C is slightly oval in shape, a transition from A. The finished template is shown in Fig. 14, and the shape of the pattern it forms is given in Fig. 15. Section Z requires making a second template which is developed by following the



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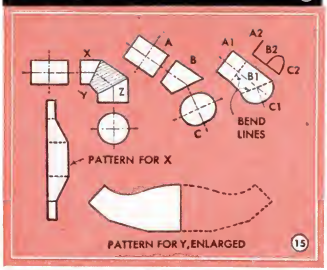

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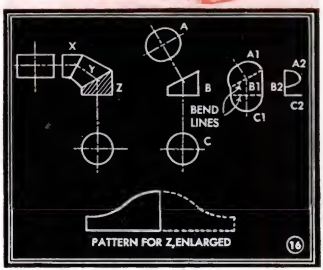

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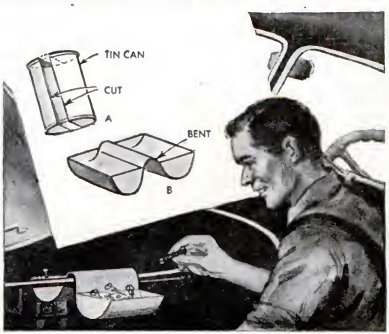
same steps as previously described. A, B and C in Fig. 16 represent the size and shape of the two ends and the cross section. Note here that A is oval shaped now as was C in Fig. 15 and that it is the same size. Half of A and C are added to B, after which the template is cut and the ends are bent 90 degrees. The shape of the pattern for Z is shown in the diagram.

Remember in laying out a template there are just two things required. First, you must determine the cross section of the fitting and second, the exact size and shape of the two ends. It's as simple as that.

Courtesy American Rolling Mill Co.

Handy Tray for Automobile Parts Fits Over Strut Rod

If a quart or half-gallon oil can is cut and bent as shown, it will make a handy two-compartment tray for small automobile parts. The tray fits over a strut rod. Care will have to be taken to see that the two compartments balance.



Waterproofing Boots

Leather boots which are worn outdoors in all kinds of weather should be waterproofed for comfort and best wear. One waterproofing formula which is used is composed of equal parts of beeswax, neatsfoot oil and pine tar. These are melted in a double boiler, applied to the boots with a brush and then rubbed by hand.

Notch in Drawer Provides Holder For Letter-File Folders

By notching one of the drawers in your desk, you can provide a handy holder for letter-file folders. Any letter in the file is accessible instantly for copying or reference, and it is not necessary to go through the file and pull out the letter you are looking for.—G. E. Hendrickson, Argyle, Wis.

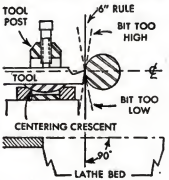
Holes Drilled in Steady-Rest Jaws Lubricate Work in Lathe

To lubricate work in a steady rest, one mechanic drills the jaws as shown, using a fairly large drill, and fills the holes with tailstock lubricant, such as white lead in oil. This lubricates work in the rest.—W. S. Kals, Vancouver, B. C., Can.

It's Less Effort to Time Ignition Before Assembling Engine

New pistons, rings and bearings "stiffen" an engine and make it difficult to turn over by hand when timing the ignition. Actually the crankshaft is all you need in place for this operation, so just make a partial assembly, omitting pistons and connecting rods and leaving the main bearing caps a little slack. Then after the ignition is timed and the valves adjusted, the engine can be completely assembled and tested.

Lathe Tool Centered Using Scale



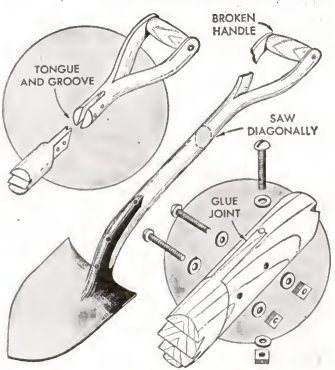
When using this simple trick, you can set a lathe tool on the horizontal center line of round work quite accurately. Hold a 6-in. steel rule or scale alongside the work as shown and run the lathe tool up against it lightly. If the top of the scale cants toward you even slightly the tool is too low. But if the top end of the scale cants in the opposite direction the tool is set too high. When the rule stands perpendicular to the bed of the lathe with the tool bearing against it, then the cutting tool is on the center line of the work.

Robert A. Ridout, New Castle, Ind.

Hand Grip Spliced to Shovel Repairs Broken Handle

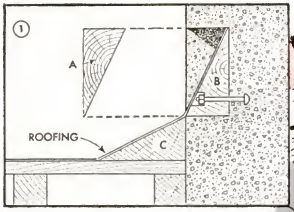
If the grip on your shovel is damaged, and you have a broken shovel with a good handle, you can make a very satisfactory repair. Cut the broken grip off at a diagonal and cut the replacement part at a matching angle so the two will fit properly. Then cut a tongue-and-groove joint and after fitting the two together drill holes for two horizontal and one vertical bolt. When assembled, you will have a sound handle.

R. E. Murray, Fremont, Ohio.



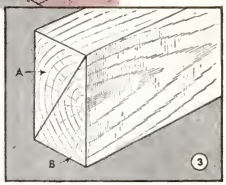
Home Repairs

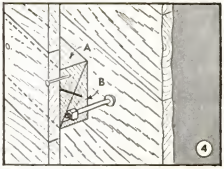
Undercut Walls Eliminate Metal Roof Flashing

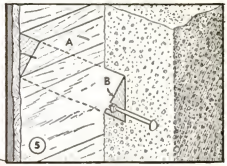


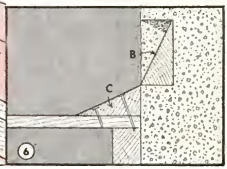
By Duane I. Hurd

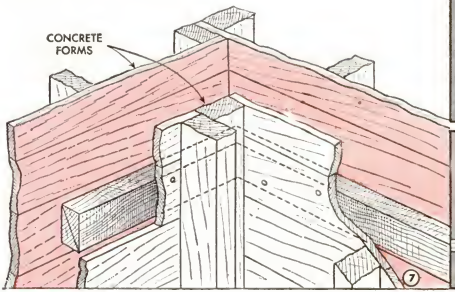
HERE'S a practical roofing kink which is especially suited to flat-roof garages, Fig. 2, and similar structures having either brick or concrete walls. It consists of a wood-lined undercut or recess cast in the wall at the time of pouring or formed in the brickwork by means of a wooden pattern the parts of which later are used as a nailing base for the roof covering. After the concrete forms are up, 2 by 4-in. stock is ripped diagonally lengthwise as in Fig. 3, forming the pieces A and B as shown. The latter piece is fitted with 6-in. bolts, spaced 2 ft. apart and set flush. Then the piece A is nailed to it as shown in Fig. 4. The top edge of the piece A should be coated with grease so it will not stick to the concrete or mortar. After this, the whole thing is nailed or screwed to the inside of the form, Fig. 7, screws being better for this purpose as the piece A is easily removed later and saved. The two pieces should be merely tacked together lightly so that they will part easily when the form is removed, Fig. 5. A third piece, C, is now ripped from 2 by 4-in. stock as already described and nailed to the roof boards in the position shown in Fig. 6. Finally, roofing is laid as in Fig. 1, part A being renailed to part B as the finishing operation which brings the recess flush with the wall. A coating of roofing tar worked into the joint finishes the job.









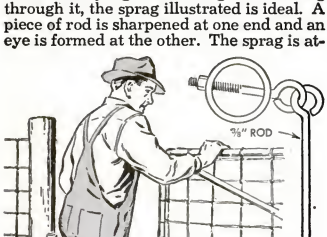


Strips of Cardboard Form Holders To Support Display Cards

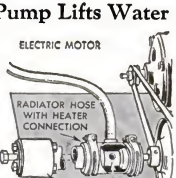
The window trimmer in one store makes holders for display cards by using a strip of heavy cardboard about 3 or 4 in. wide. Slits are cut in the ends which then are folded over and bent up. The display card fits into the two slits.

"Sprag" Arrangement Holds Gate In Any Opened Position

To hold a farm or driveway gate open while carrying something or driving through it, the sprag illustrated is ideal. A piece of rod is sharpened at one end and an eye is formed at the other. The sprag is attached to the frame of the gate with a bolt and a hook is fastened to the wire mesh of the gate to hold the sprag out of the way when not in use.



Modified Oil Pump Lifts Water

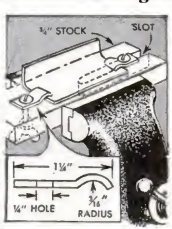


With a few changes, the oil pumps used on some cars can be used to pump water from flooded basements, springs, ponds or other shallow depressions. The pump will perform best when the intake end of the pump is directly in the water or near it. In order to make an outlet connection for this particular pump, a short piece of radiator hose was slipped over the body and clamped at each end. Then a connection was made to this hose in much the same manner that a car heater is connected. A belt drive transmits power to the pump. Pvt. Burrel P. Wilburn, Wichita Falls, Tex.

Heat Will Remove Plastic Stock That Is Frozen to Tool

When machining some plastics, too fast a cutting speed or too much pressure on the tool will soften the plastic with the result that part of the stock removed freezes on the cutting tool. If gentle heat is applied by means of a flame or soldering iron, the plastic will soften and can be wiped from the tool. Care should be exercised not to draw the temper of the tool.

Filing Jig for Channels and Angles



Short sections of channels and angles can be held firmly for filing or grinding by using the jig shown. A slot in one end makes it adjustable for various lengths of material. The hold-down clamps are made of flat-iron stock and are tightened with wing nuts. Three-quarter-inch plywood or pressed board makes the best base, and the bolts should be 9/16 in. in dia. with the hole and slot large enough to accommodate them.

Wallace H. McClay, Pasadena, Calif.

Reprinted S.N. 48

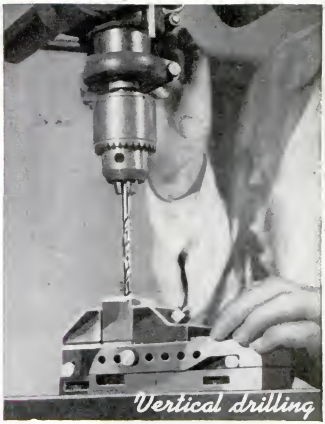
Precision SINE BAR VISE

By Walter F. Debold

FOR the shop machinist who likes to make his own precision tools, the sine bar vise is a neat piece of machine work calling for close tolerances—a precise and versatile tool that can be used in such operations as checking, layout, drilling, reaming, jig boring, surface grinding or almost any machine-shop job requiring a high degree of accuracy on both angular and straight work. With this vise and the aid of planer gauge blocks any angle can be set up within plus or minus 5 minutes of a degree. Also, it can be used as an ordinary toolmaker's vise on a wide variety of precise work.

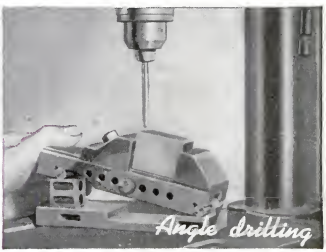
Most machinist's handbooks will give the sine of the angle for 1 in., which, in ordinary calculations, is multiplied by 5, the distance between the two vise pins. As an example, to set up an angle of 30 deg., the sine of the angle is found to be .5000. Then .5000 times 5 will equal 2.5000. The planer gauge is set to this dimension with a micrometer and is placed under one vise pin. This setup gives an accurate angle of 30 degrees for angle drilling, surface grinding and other operations requiring angular setups of the work.

All parts of the vise can be made from machine steel, carburized and hardened, or they can be made from tool steel and heat treated. Probably most machinists would choose the latter method because of the superior wearing qualities and the finer finish that can be obtained on tool steel. Fig. 2 shows the finished vise with the body in a raised position. Parts of the vise that are to be hardened should be finish-ground after heat treating, on all surfaces affecting accuracy, as these operations in turn determine the accuracy of the vise. It is necessary to allow 1/64 in. all around for finish grinding after hardening. The detail drawings in Figs. 3, 5 and 6 show the finish sizes. The most important dimension to hold is 5.000 in., Fig. 3, as the accuracy of this dimension determines the accuracy of the angles. The steps that anchor the pins are

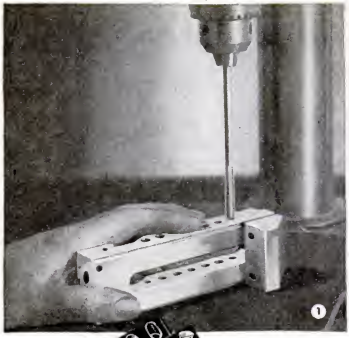


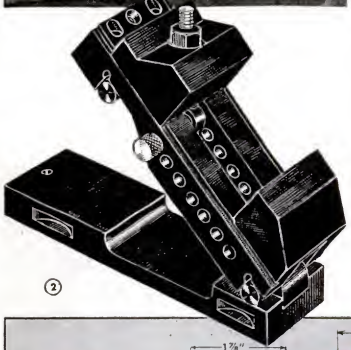
Here the sine bar vise is being used as an ordinary drill vise to hold work for a common drilling operation

With the aid of precision gauge blocks any angle can be set up within plus or minus 5 minutes of a degree



Angle setup for drilling on an ordinary drill press. Drill must be properly ground to prevent drifting

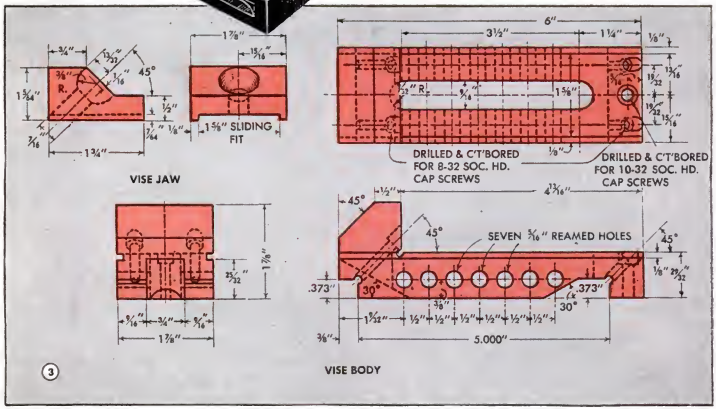


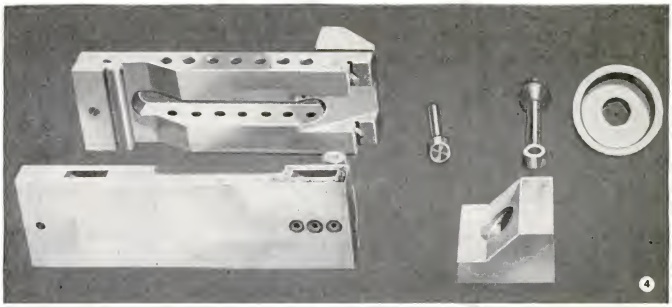


so designed that it's easy to bring the distance between the parallel faces to the exact measurement.

As a rule it's best to start construction with the vise body, Fig. 3. This is roughed out on the milling machine or shaper, allowing 1/64 in. for finish grinding. Next, holes are drilled, reamed and counterbored, Fig. 1, to the various sizes indicated in Fig. 3. In this work it is necessary that the drill bits be ground to the proper angle to minimize the possibility of inaccuracies due to drifting of the bit. Notice that there are three chip-clearance holes in the vise body, although actually only one hole serves this specific purpose. For this reason the exact diameter of the holes is of no particular importance. Milling cuts for forming the ways for the guides milled on the sliding jaw are run straight through the thickness of the fixed jaw. This avoids the necessity of stopping the cuts within definite limits and adds something to the appearance of the finished job. The locking pin, Fig. 6, is a part of the body assembly and may be made at this time. The pin is simply a rough-turn, finish-grind-and-knurl job which can be done in the lathe.

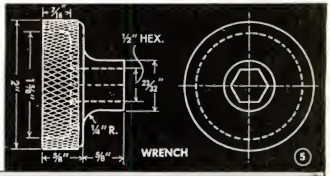
Next comes the sliding jaw, detailed at the upper left in Fig. 3. After roughing out to the required shape, there remain the end-milling cuts and one counterbored hole at an angle of 45 deg. to finish the machine operations on this part. The counterbore takes the swivel screw and nut detailed in Fig. 6. The

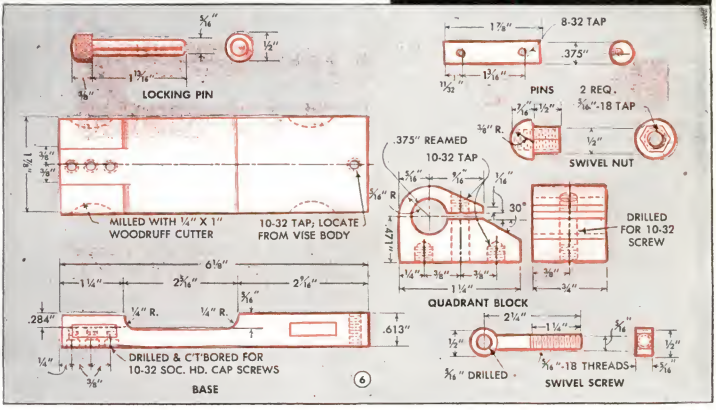




swivel screw pivots on the locking pin, and the swivel nut and wrench, Fig. 5, provide a fine adjustment on the sliding jaw. The hexagon socket of the adjusting wrench is really a broaching job, but because of the through-hole it is possible to do a creditable job with an ordinary hand file.

Finally, there's the roughing out of the base and the quadrant block. The machine operations on these two parts require working to "hold" dimensions. Cuts made on both sides of the base with a ¼ by 1-in. Woodruff cutter provide openings for clamps. The slot milled in the base for the quadrant block must be held to exact depth in the finish grind, likewise the finish grind on the quadrant block must bring it to a smooth push fit in the slot. The hold dimensions on the two parts provide .0005 in. less than theoretical clearance when the parts are assembled. This gives a velvet-smooth hinge action between the body and the base when the vise is being set in the angular positions. Turning out the two pins, upper right-hand detail in Fig. 6, finishes the parts ready for heat treating and finish grinding. This done, you have the set of parts shown disassembled in Fig. 4. The assembly is quite simple.





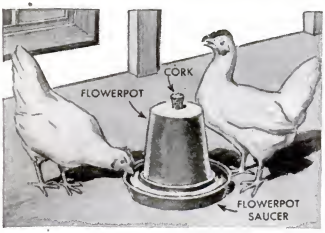
Light on Edge of Welding Helmet Aids When Inspecting Work

As an aid when inspecting work done in locations where the light is poor, one welder fastened a flashlight bulb to the lower edge of his helmet so that it would illuminate the work when the helmet was raised. The battery is fastened to the top of the helmet in such a way that it will touch a contact and close the circuit to the bulb when the helmet is raised. When the helmet is down, the circuit is broken and the light is off.

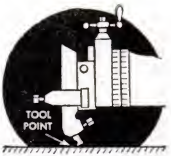
Norman W. Radcliffe, El Sobrante, Calif.

Poultry Fountain From Flowerpot

For an emergency poultry fountain, one farmer utilizes a flowerpot and saucer. First the drainage hole is corked, then the pot is filled with water and the saucer is placed, face down, on top of the pot. When inverted, the fountain is ready for use. Because contact between the pot and saucer is not perfect, water will escape into the saucer. The saucer should be at least 2 in. larger in diameter than the pot.



Reversed Holder Prevents Tool Digging Into Work

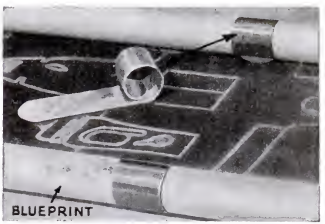


In shaper work, difficulty sometimes is experienced when taking heavy cuts with a straight tool holder. There may be a tendency for the tool to chatter or to dig into the work. If the holder is reversed, tendency of the tool to dig in will force the point away from the work rather than into it.

Emil Wittmann, Philadelphia, Pa.

Holders for Prints and Tracings Permit Easier Handling

Draftsmen will appreciate these holders for rolled blueprints and tracings since they will enable them to handle large drawings without weighting down the corners. The drawing can be entirely unrolled, or only



a part if that is all that is necessary. The holders are made of thin sheet metal about 1½ to 2 in. wide and 10 in. long. After the curve is formed, the flat part should measure about 6 in. The ends should be rounded and the edges beveled for convenience in handling.—Peter A. Bono, Springfield, Ill.

Substitute Asbestos Car Washer

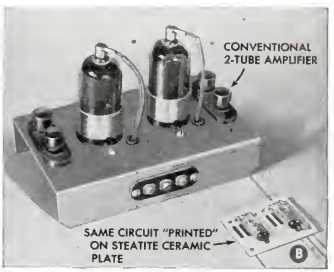
When repairing an automobile or other internal combustion engine, if it is found that any of the copper-asbestos washers are no longer usable, asbestos string may be substituted. Three or four turns of the string should be sufficient. If the washer is of an odd size and difficult to replace, this substitute will be especially convenient.

Ivan J. Stretten, Detroit, Mich.

"PRINTED" RADIO CIRCUITS

SILVER lines replace copper wires in the "printed wiring" method for radio circuits that employed tiny tubes used in the proximity fuse, one of the secret war weapons. Developed by the engineers of Globe-Union, Inc., Milwaukee, Wis., this "printed hookup wire" solved a difficult construction problem as it was necessary to design a radio transmitter and receiver small enough to fit on the end of a mortar shell. Tubes about an inch long and slightly larger in diameter than a lead pencil are employed in these circuits that were "printed" on flat ceramic plates.

The lines of "silver ink" are painted over a stencil to form two-dimensional wiring. Carbon resistors are painted in with a carbon solution to complete the circuit, after which the plate is reheated to burn off the solvents. This idea of using carbon lines for a resistor is not new as many early radio experimenters used the same idea for making "resistors" with a lead pencil on a piece of paper. The young lady in photo A is using a small pen-type soldering iron to fasten the tube leads to the silver leads on the ceramic plate. Photo B shows by actual comparison what is accomplished with this method. The schematic diagram for both units appears in Fig. 1. All fixed condensers are small paper-thin ceramic disks silvered on both sides. The silk screen stencil-making process is illustrated in photo C. Manufacturers may decide to employ the new development for tiny receivers and electronic devices.



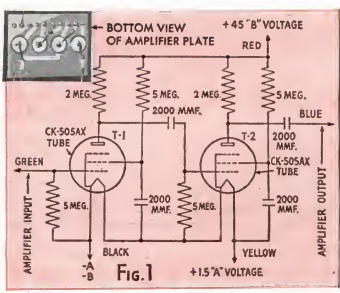
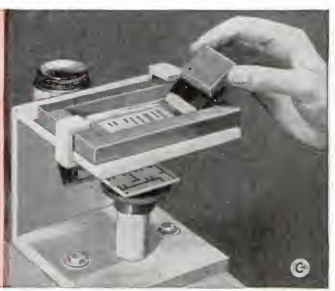


FIG. 1



BUILT-IN RADIO

By W. H. Blankmeyer

NEARLY every home has at least one suitable location for a built-in receiver. When properly installed in a wall, library shelf or cupboard, the set is out of the way and there are no trailing wires. The permanent installation has several other advantages; for example, the loud-speaker may be mounted in a wall which provides a nearly infinite baffle for improving tone. The object is to separate the speaker front from the back by as much wall, or baffle, distance as possible, thus preventing low-note cancellation. It is also a simple matter to install remote PM speakers controlled from switches near the receiver panel.

A typical way of installing a radio chassis on a shelf in a built-in bookcase is illustrated in sketch Fig. 1. A neat and modern appearance is obtained by using a front panel which simulates a row of books. The speaker may be mounted several shelves higher and is provided with a grille of the same description backed with an appropriate cloth as detailed in Fig. 2. Decorating the set panel or speaker grille offers an opportunity for originality; however, the background color should harmonize with the other bookbindings. The vertical lines representing spaces between the books can be black; the book titles, gilt.

The bookshelf installation, Fig. 1, clearly shows the method by which proper ventilation is obtained. A space above the panel permits the heated air from the chassis to escape. To permit circulation, a dozen or more holes about 1½ in. in diameter are drilled in the shelf. The new control panel is supported on each end by wood strips and is made of plywood or other suitable material. In many cases it will be necessary to use extension shafts to bring out the controls.

All wiring to the chassis must be of the approved type and concealed for appearance. Antenna and ground outlets and the power outlet may be mounted at any convenient point on the side or rear of the bookshelf. Easy accessibility must always be considered. A speaker plug and cable

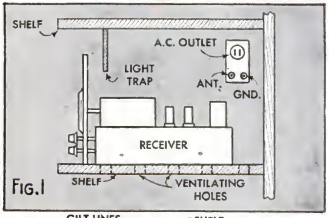


FIG. 1

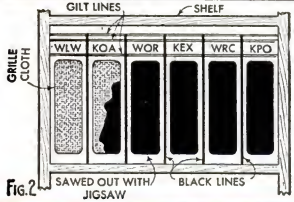


FIG. 2

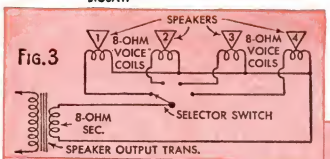


FIG. 3

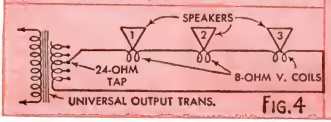


FIG. 4

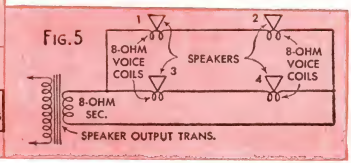


FIG. 5

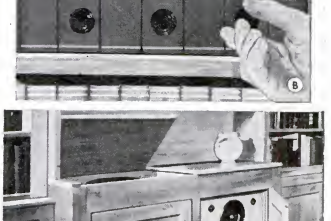
with EXTENSION SPEAKERS

hookup from the set chassis to the remote speaker, or to a small control panel near the receiver if more than one speaker is employed, completes the installation. Sketch A and photos B and C illustrate practical built-in receiver suggestions.

When several remote speakers are employed a simple selector switch is used to feed the audio power from the set output transformer to the desired PM speaker voice coil as detailed in Fig. 3. If several speakers are to be used simultaneously a universal output matching transformer is required as shown in diagram Fig. 4. The 8-ohm voice coils are connected in series, making the total impedance match at the 24-ohm tap. The universal output transformer will replace the one you have in your set and will match almost any speaker combination. If your speaker impedances are unknown try several different output taps for the best results.

Fig. 5 shows an idea for connecting several speakers without a matching transformer. This series-parallel combination matches an output winding intended for one voice coil when the number of speakers in series is the same number as those in parallel. Any installation using several speakers simultaneously divides the audio power output among the speakers, therefore your set must have sufficient output or the volume will not be satisfactory. To control the volume level of a speaker in any of the above arrangements separately, either at the remote speaker location or from any point along the connecting wires, a constant impedance control is necessary. The 8-ohm "L" pad, a dual resistance unit, shown in diagram Fig. 6 will serve to do this without disturbing the volume control setting at the receiver. The "L" pad must have the same impedance rating as the controlled speaker voice coil. The pad is merely connected in the leads to any individual speaker to be controlled. There is no blueprint for this article.

Wire for connecting extension speakers may be No. 18 annunciator, 2-conductor rubber-covered wire such as flat lamp cord, or regular No. 14 duplex in conduit.



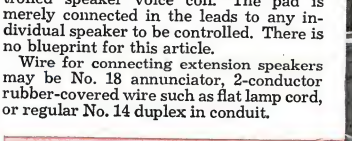
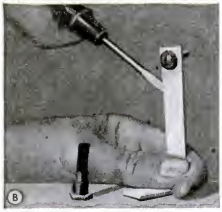


FIG. 6

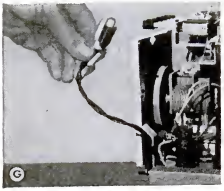
Blueprints covering radio construction articles in recent issues are available for 25 cents each; detailed student material lists, and additional information, can be obtained from our Radio and Electronics Department without charge on receipt of ordinary letter postage

Helpful SERVICE HINTS

(A) When removing tubes for checking purposes make sure that each socket is clearly marked for identification. Some manufacturers paste tube lineup charts on the inside or bottom of the cabinet instead of marking each tube socket; if the cabinet is changed or the chart is damaged, tubes may be inserted in the wrong sockets. Always turn off the set or disconnect it from the line supply before changing tubes. (B) Cardboard guide for starting screws in hard-to-reach locations. The screw, with washer in place, is inserted through the thin strip of cardboard which is easily pulled away after the screw is threaded into position. This idea is especially useful when repairing compact table-model receivers where the wiring partially covers mounting screw holes



(C) Unless you have a detailed circuit diagram do not remove a volume control or other part from a radio receiver without first making a sketch of the wiring to such parts, showing the color coding of the wires, to insure correct replacement. (D) A marble bag or tobacco pouch saves knobs and screws during service operations. One misplaced screw or small part is often the cause of delay and many lost programs



(E) Headphones in series with a small B or C-battery for continuity checking; if circuit is complete a distinct click is heard. (F) Loose tube shields make poor chassis ground contact and cause noise. (G) Twist pilot light leads to reduce hum. (H) Spring clips on ohmmeter leads leave hands free for checking intermittent short or break in line-cord resistor

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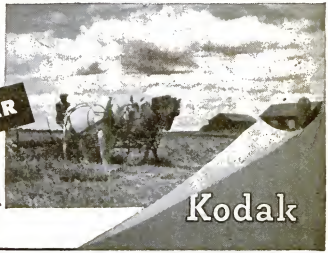

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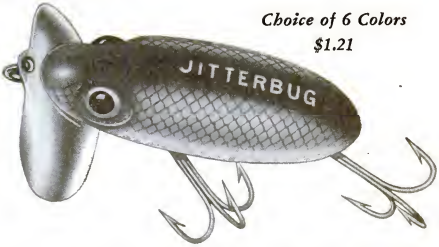

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Putting a Madcap River to Work

(Continued from page 157)

Angeles River isn't tired of its part in the job. The port has used 10,000,000 cubic yards for terminals and has had enough left over to widen Long Beach's eight-mile bathing beach.

The dredges used in the construction look like top-heavy scows. The "Los Angeles" is a typical boat. The vessel is 130 feet long with a draft of seven feet. A giant A-frame supports a 70-foot ladder upon which is mounted a six-foot, five-bladed rotary cutter and a 30-inch suction pipe.

"Walking" slowly across the sand-filled sea, the dredge eats a 225-foot arc from the deposit of sand on the bottom, going as deep as 50 feet to find its food. A three-ton impeller in the 1500-horsepower electric turbine thrusts the dredged material through a mile of 27-inch pipe at 21 feet per second. Only about six percent of this material is solid, the rest water. But 1000 cubic yards of solid sand are moved through the pipe line each hour.

Through hot summer months the dredges work fast to clear a place for the river's winter and spring load of silt. From the rusty throats of huge pipe lines muddy water gushes into diked areas. Seagulls by thousands scream over the muddy fills, feeding on minced shellfish.

Costs of dredging sand from the river and depositing it in land fills range from 12½ to 32 cents per cubic yard, depending on the volume, location and depth and the distance the material must be pumped.

The harbor's future facilities will include a huge ultramodern base for seaplanes. The Port of Long Beach is determined that its future construction will meet the needs of modern world commerce. Shoemaker, the chief engineer, is removing all obsolete designs from the plans. Structures along the new piers will have built-in wartime im-

(Continued to page 224)

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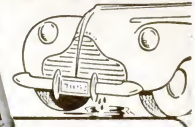

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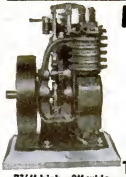

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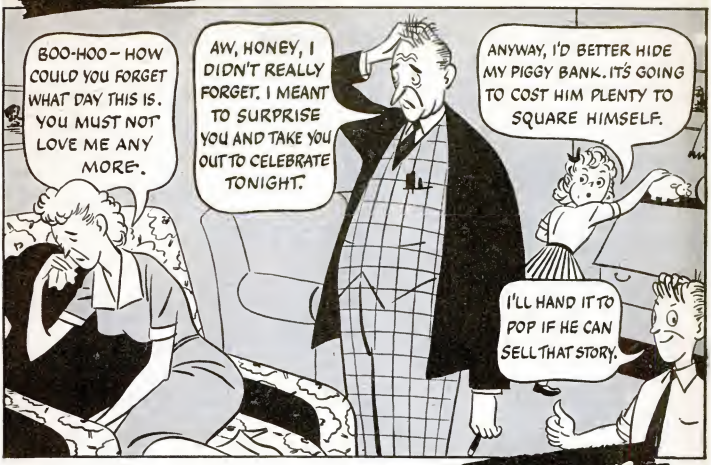

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provements that have enormously increased the efficiency of cargo handling.

Shoemaker estimates the future frontage of the Port of Long Beach at 25 to 30 miles. When that potential has been reached, the port will have used nearly 50,000,000 cubic yards of sand—carried free by the temperamental Los Angeles River.

Rough Riders on Water Skis

(Continued from page 120)

ture. The blimp, moving along at good speed, struck an uprising current and jumped high into the air. MacDonald was pulled off the water. In a few seconds he was dangling 150 feet from the surface. He had stirrup-type grips on the tow line and hung on until the blimp was brought down and placed him back on the water.

Competent skiers often work in pairs behind a fast boat, changing sides by ducking under one another's tow lines. One man, skiing beside his partner, can drop one ski, step on his partner's and then drop his other ski so that both are riding the same pair. Ski enthusiasts have ski-jumped off ramps at 40 miles an hour.

Any fast and maneuverable boat makes a good tow boat. Some enthusiasts build their own utility runabouts, from 15 to 20 feet long with enough power for speeds up to 45 miles an hour. The most popular inexpensive boat is the "crackerbox" type, so-called because it consists of plywood panels that are easily assembled. A practically flat bottom and straight vertical sides make it easy to build in a back yard. Usually a crackerbox is powered by an automobile engine. Tow lines are of stout half-inch cord from 30 to 50 feet long with a wooden crossbar or individual stirrup-type hand grips at the end.

The pay-off in ingenuity goes to one California enthusiast who didn't always have a partner to man the boat. He rigged up remote controls so he can ski at 30 miles an hour with no one aboard the boat. His tow line is secured to the end of a metal bar attached to the top of the rudder shaft. When he swings to one side and holds his tow line at arm's length he moves the rudder to one side, turning the boat in that direction. Another cord leads to the engine throttle. A spring normally holds the throttle closed, but tension of the tow line pulls the throttle open. When the ski rider takes in a few feet of tow line and then slacks off on it momentarily, the throttle is pulled shut by its spring, slowing down the engine. By repeatedly taking in line and then slacking off, the boat's speed can be brought down to 10 miles an hour.

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Put two small pieces of scrap lead in an ordinary glass partly filled with a weak solution of sulphuric acid and water . . . pass direct current from a battery charger through the unit for about a half hour . . . then reverse the direction for the same length of time. You have a storage battery . . . of very low capacity and very short life . . . yet it embodies the basic theory of storage battery construction.

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John J. Hall and Herman S. Burgess, famous ship model experts, at work on a 60-inch model of Robert Fulton's "Claremont". In background, four-foot model of the old "Constitution". Note they're using X-acto tools.

"You'll build better models with X-acto!"

"WE'VE used X-acto Knives and Tools for years . . . and we recommend them highly to all model builders," say President Burgess and Commodore Hall of New York's Model Schooner Club.

And that's advice worth heeding, for Hall and Burgess boats are consistent winners at the annual Model Yacht Regatta in Central Park.

Whether *you* are an amateur or a professional . . . a model builder, whittler, or the family Mr. Fix-it, you'll do a slicker job, and *quicker*, with these removable blade hobby knives. And now that the war is over, X-acto Knives are *all-metal* —no more substitute plastics!

X-acto is sharp as a surgeon's scalpel, easy to use as a pencil. Designed for safe, sure control, it adds skill to your wrist, zip to your work.

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With 13 blades, and 3 solid duraluminum handles, X-acto cuts smooth as a whistle . . . paper, leather, solid wood . . . with or across the grain, into hard-to-reach places, round sharp curves and corners. A special chuck collet locks blades firmly so they can't fold under.

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The Mechanics of Golf

(Continued from page 127)

Of course there is always room for improvement, but my putting results have been satisfactory enough so that I am content to continue with the grip I have been using. I feel that the principal hope for improvement lies in additional practice.

Photos on page 125 show how I grip my putter. Many golfers unnecessarily make hard work of putting. The proper putting stroke is very simple. The most important items to remember in putting are (1) keeping the blade of the putter perfectly square to the hole, (2) taking the blade back from the ball exactly on a line from intended direction of ball back through the ball, (3) keeping clubhead low throughout backswing, (4) stroking the blade through on line with intended direction of ball.

Because it is necessary to follow through with the clubhead on the longer putts, my right elbow slides off my right hip and toward the pin after the ball has been hit.

Now that we have studied in detail the technique of hitting all the shots commonly used, let's step out and play two holes together. (Photos on pages 126 and 127.)

Our locale is the beautiful Colonial Country Club at Fort Worth, Tex.

The first hole is a 561-yard par 5 dog-leg to the right. The green lies below the point indicated by the arrow. I want to hit the ball between the two trees at the right, for that is the shortest way to the green.

My drive travels 273 yards, leaving me still 288 yards from the green. This means I can hit a full brassie (No. 2 wood) for my second shot. This shot is good for 256 yards and brings the ball within 42 yards of the green. But there is a trap looming up between the cup and me.

Oh well, let's not worry too much about that. We'll take a double-duty niblick out of the bag so we can hit the ball high and put backspin on it. This will make it stop where it lights. My pitch to the green finds the ball stopping four feet from the cup.

My putt is good. I score a birdie four.

As I drive for the second hole—a 395-yard par 4—I try to make the ball slice (curve to the right) around the left side of the tree looming up before me.

To get an intentional slice I first take an open stance such as we studied in Part 1 of this series. As I start the backswing, I force my hands and the club away from my body so the clubhead will follow an upward arc outside the line of flight. As the clubhead follows this arc down to the ball, it cuts across the ball from outside to inside the

(Continued to page 232)

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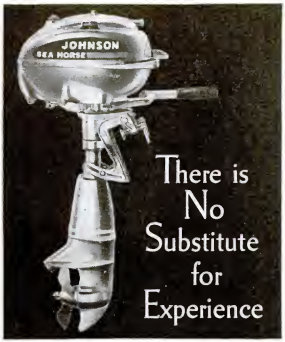

This is the famous Johnson Sea-Horse Model TD—the outboard motor that "has everything"... It develops 5.0 O.B.C. CERTIFIED brake horsepower at 4000 r.p.m. It is built with all the major refinements (27 of them) that make for outboard quality. It is prized above all for its DEPENDability. And, of course, it is the motor that gives you "The Big Three" of outboard motoring—Johnson Perfected Alternate Firing, Reverse and Dual Carburetion.

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Just the saw horse for your workshop

The FOLD-A-HORSE (Patented)

Folds away to 8" x 9" x 42" for storage

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There's no longer any need for your saw horses eating up valuable workshop or storage space—just fold them down to a neat 8" x 9" x 42" package and slip them into a corner. Then too, the Fold-Horse probably is more rigid than most one-piece horses. It is assembled with 14 gauge, cadmium plated steel hardware. It's easy to assemble—easy to knock-down! Top is standard 2" x 6" x 42" and tool tray measures 9" x 36". Place your order right away to assure prompt delivery. Lists $9.95 each.

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Fill the Dustless brush reservoir with Arbitrin sweeping fluid. In the process of sweeping, this fluid filtering through the tufts makes sweeping compound out of dust on the floor. The result: You eliminate up to 97% of the dust in the air between sweepings. You also have cleaner floors and cut sweeping costs. Thousands of factories, shops, stores, and schools now use "Dustless" sweeping. Write for complete facts today.

The result:

Germ culture after ordinary sweeping

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- Speed Wash brushes

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line of flight and causes it to spin in such a manner that it curves to the right.

Because I have sliced the drive, the ball won't travel as far as a normal shot with a driver. My drive is out about 247 yards.

For my next shot I take a No. 7 iron, with which I place the ball on the green, 148 yards away. You can see the blade cutting through the turf, and the ball just starting to rise. The shot rolled about 12 feet past the cup, so I have quite a putt "coming back." No! They don't all go in. I missed this one and must settle for a par four on the hole. After all, if we made every putt, it might get monotonous. Guess none of us ever has to worry about this!

I've been so busy playing in tournaments that I don't very often get around to talking over the technique and mechanics of golf any more. I'm sure it has done me a lot of good to check up with you on what it takes to hit a ball well, and to go over my game at the same time.

I can't guarantee you that you'll go out now and break the record at your favorite course. The final result is up to you. If you study the various details of these three lessons closely, and then practice diligently, I feel certain you can improve your golfing form and get better scoring results—that is, unless you are already an expert.

My personal feeling is that there is always room for improvement in this fascinating, healthful game. If you will pardon a final personal reference—in 1944 I averaged 69.67 strokes per round for 85 rounds of official tournament golf to win the Radix trophy. At the time I thought this was as low as I could ever get.

However, I continued to study intently and practice intensively. My average score for 120 rounds of play in P.G.A. sanctioned tournaments during 1945 was 68.33, an improvement of more than a stroke per round.

I want to thank you for your attention and indulgence. Until we meet on the fairways, "So long, and better golfing!"

Forecasting the Ocean Waves

(Continued from page 140)

into a plowshare of peace. Dr. Sverdrup says that a large program under development calls for a world-wide network of scientific stations to record sea swell. The British already have a station on the west coast of England and it is expected that the U. S. Navy or some university will set up facilities on our side of the Atlantic.

A station for observing swells has been set up at Humboldt Bay on the Pacific Coast and a second station will be estab-

(Continued to page 236)

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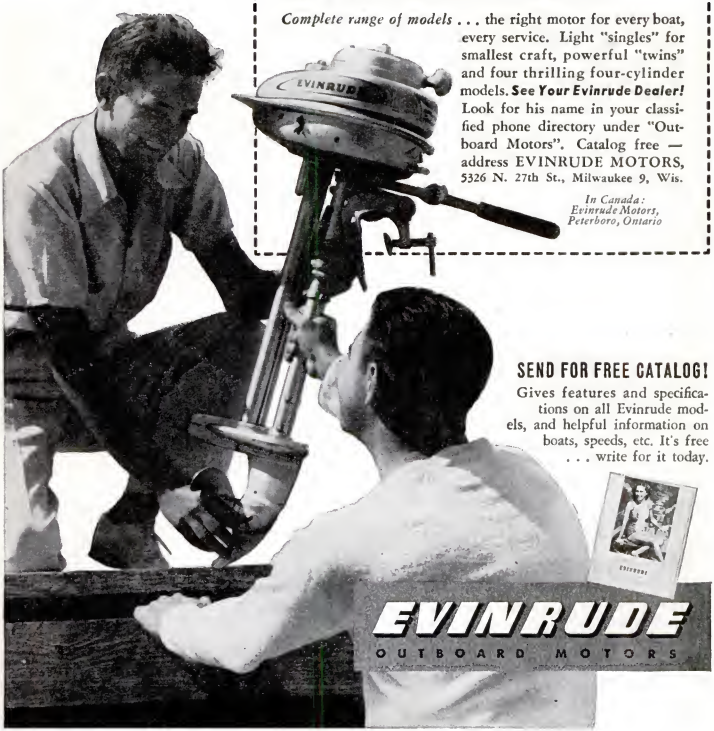

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lished in La Jolla this spring. A third may be set up on the tip of Lower California.

Special instruments have been developed for these swell-recording stations. Instruments near the shore record the pressure exerted by each passing wave, thus measuring the size of the wave.

Deep-water instruments are more complex but highly efficient. Attempts now are being made to fit a deep-water instrument with a small radio transmitter which could be dropped from a weather ship in mid-ocean to report its findings by radio.

Many peacetime applications of the new knowledge of the sea gained in four years of amphibious warfare are foreseen by Dr. Sverdrup:

(1) Tankers that take on oil from pipe lines some distance from the beach can be warned when heavy swells are expected.

(2) The Coast Guard can give small craft better warning when swells approach a coast.

(3) Warnings can be issued to bathers and beach homeowners.

(4) Knowledge of surf can be used in studies of how piers, breakwaters and other man-made structures affect beach erosion.

(5) Pilots of commercial planes flying over ocean areas can at all times be kept informed as to the state of the sea. If forced down, they will know what to expect.

(6) When rescue operations of planes and ships have to be made, knowledge of the sea conditions will be indispensable in saving lives.

(7) Finally, adequate observation of sea and swell can supplement weather information and lead to improved weather forecasting. Tropical storms may be located by means of the swell which spreads out from the storm area and typhoons and hurricanes can be tracked.

What Kind of a House Do You Want?

(Continued from page 104)

public may have been led to expect, they contend that the average builder today (particularly the ex-serviceman who has saved toward a home) wants a conventional house as he knows it. He is not satisfied with a converted streetcar, a concrete-clad igloo or a hut-type dwelling even if it is made of platinum. He wants the kind of a home that he has dreamed about at odd moments for years, a place to be proud of where he can raise his family and enjoy life. If he finds he doesn't have enough money to build the kind of house he wants,

(Continued to page 240)

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insure accuracy — tell tension as bolt is tightened...

WHERE specifications call for accurate, *uniform* stud or bolt tension, Torqometers should *always be used.* "Guesswork" tightening is an open invitation to all the troubles that follow mechanical distortion . . . wasted power, dangerous wear, breakage of parts. Even highly skilled mechanics cannot be expected to approximate specified pressures.

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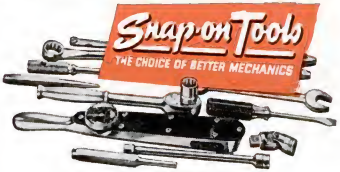

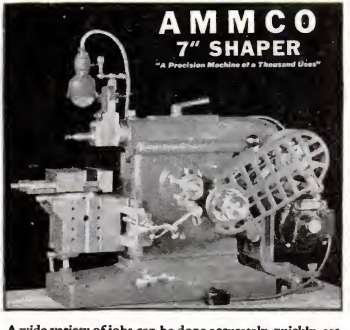

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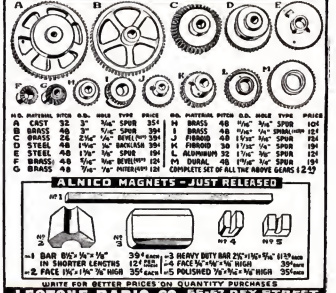

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Singles fit in place of regular mufflers.
Chevrolet, V-8, Plymouth to '42—Steel $5.50, Aluminum $6.50. Chrysler, Oldsmobile, Buick, etc.—Steel $7.50, Aluminum $8.50. Sandee steel mufflers will outlast two regular stock replacements. Sandee "Aluminums" are guaranteed for the life of the car.

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It's easy to hone keen cutting edges on your chisels and plane blades. Precision adjustment for ANY ANGLE of bevel. Roller glide makes every stroke uniform across oil stone. Light, strong—ideal for home craftsmen, hobbyists, carpenters, cabinet makers.

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See the new Ta-pat-co Life-Save Vests and Life Preserver Cushions at your sporting goods store.

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The AMERICAN PAD & TEXTILE CO.

GREENFIELD OHIO

he prefers to rent one or live in an apartment for $45 or $55 a month, according to Mr. Wright and his researchers. (Sidelight: 30 percent of the people living in cities in 1940 occupied apartments.)

Will you decide upon a prefabricated house, either of conventional or modern design, and in the price bracket from $4,000 to $10,000? The federal housing administrator is expecting big things from the prefabrication industry which has been experimenting for years with various kinds of materials: plywood, concrete, metals, plastics, gypsum board and other kinds of wallboard. During the war the industry constructed more than 200,000 prefabs, mostly emergency housing. The FHA is calling upon the industry to supply 250,000 housing units this year and 600,000 in 1947. This came as a surprise to a young industry that had expected to produce only about 30,000 units in 1946.

The prefabricators are or soon will be offering houses that range from the circular Fuller house made of aluminum and suspended by cables from a central steel mast (see Popular Mechanics, June '46, page 118) to the conventionally attractive Defoe and Gunnison homes. The cost of the Gunnison house includes foundation, erection, wiring, plumbing, bathroom equipment, heating, sidewalks and landscaping. The financing is arranged so that monthly payments do not exceed one week's pay per month—the generally accepted rule for financing any type of house.

Two advantages to which the prefabrication industry points with pride are (1) the quoted price for the complete house eliminates the "extras" that often boost costs above what the builder had expected to pay, and (2) speed of construction. Most prefabricators can get the house under roof in a single day and finish the job in a week.

Builders of the nonprefabrication school insist that America is a nation of individualists, that the public demands custom-built houses and will not be satisfied with superficial changes which often distinguish one prefab from another. Prefabricators merely smile and point to the row upon row of nearly identical houses in thousands of subdivisions. With building costs averaging 50 percent higher than before the war (the highest since 1920) the public taste as in the past is largely dictated by its pocketbook.

One thing is certain: Regardless of the type of house you build today, there should be a rich harvest for the builder in new and better materials and advanced thinking along architectural lines.

Do fine craft work, faster, with a

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Trade Mark Reg. U.S. Pat. Off.

The Vibro-Tool complete with 22 accessories for engraving on steel, jewelry; decorating glass and plastics, carving on wood; cutting out patterns from cloth, rubber and cardboard, tooling and embossing leather, and many other jobs; plus sharpening stone, conveniently fitted into handsome hardwood, natural finish, hinged box . **$16.50**

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Complete including all parts, chassis panel, streamlined cabinet, less tubes, coils, and meter.
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The 8-ounce lawn-size package treats 1600 square feet! Now *you* can enjoy a beautiful weed-free lawn for *only* $1!

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War industry's most versatile machine—now available to hobbyists, craftsmen, model makers, pattern makers, home workshops—cuts fast and clean on wood, metal, plastics! Works equally well on inside cut-out openings or irregular outside edges, on intricate scrolls, curves. Saves hours of tiresome hard work—does better job. Nothing else like it. IDEAL TO GIVE OR GET FOR WORKSHOP! Sold on 5 Day's Trial, money back GUARANTEE.

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"Welder's Vest Pocket Guide"

Ears of the Sub Killers

(Continued from page 77)

scope by blobs of light. This is a visual check on the sound beam and indicates range and bearing.

As you continue to report bearing of the target and related information, the crucial action now shifts to the sound range recorder. This device is hooked up to the sound projector and to instruments indicating the ship's speed and course, and positions the target in terms of time and distance. Carefully worked out in advance are the seconds necessary to fire depth charges or ahead-thrown weapons.

Now you are almost "on" the sub. Echoes are coming back almost as powerfully as pings. There is strong "Up Doppler." This is to be an attack with depth charges. "Bearing zero-one-two," you cry. "Range zero-five-zero," calls the recorder. Only 50 yards between you and the sub. "Come right to zero-four-zero," orders the skipper. The helmsman gentles the wheel, "Right to zero-four-zero, sir!"

Green seas curling from your bow, you move across the path of the oncoming sub. Ash cans of TNT roll off your stern and Y guns toss others to each side to form a pattern around the enemy raider. Geysers of water shoot up with a thunderous roar.

But your job is not finished. This is only the first phase—unless you have made a successful hit. If pools of oil and bits of wreckage come to the surface, you can usually "scratch" one U-boat. Once in a blue moon the enemy sub itself may be forced to the surface to be pulverized by your deck guns.

As the tumult dies away and your ship circles, you're at it again—pinging in every direction for you don't know which way the sub has turned. He's probably dived deep or headed for a colder or warmer layer of water to make your job even tougher. Or he's making sharp turns that produce "knuckles" in his wake which throw back an echo almost like the hull of the sub itself. Or he's throwing out supersonic minelike noisemakers to jam your gear and return false echoes.

These are only a few of the tricks submariners employ to evade sonar detection. U-boats used them against us and we used them against the Japs.

The Battle of the Atlantic was largely one of antisubmarine warfare. Teamed up with carrier-based and land-based aircraft, surface craft equipped with sonar proved effective in reducing the number of Allied ships sunk to a very few. In contrast, Allied

(Continued to page 248)

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double thick deluxe blade
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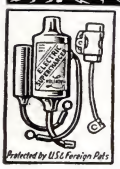

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1 "Holy smoke," moaned Reggie, "is all that rust and sludge coming out of me?" "Sure is," the service man replied. "One bottle of K & W *Radiator & Block Cleaner* is knocking all the corruption out of your system. Now if you'll open wide and say 'ah-h', I'll use K & W *Radiator Seal*."

2 "What'll K & W *Radiator Seal* do?" Reggie asked. "It will fix you up in 30 minutes," the service man answered. "If one bottle doesn't stop every one of those leaks, nothing but repair shop surgery can take care of you!" A cautious radiator at heart, Reggie asked, "Do you guarantee that?" "Absolutely," the service man shot back.

3 "Gee," Reggie smiled, "that K & W *Radiator Seal* really hit the spot. It's *not even* 30 minutes and I'm not leaking a drop."
"Of course not," the service man grinned. "Now the clincher. A K & W *Rust Inhibitor* treatment and your cooling system is all set for a long, trouble-free season."
"That's right," Reggie agreed, "*Rust Inhibitor* is the product that's famous for keeping rust and scale from forming!"

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These valves used where carburetors have outside attachments.

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10-24	25	5/16-24	I	1/4	7/16
12-24	16	3/8-24	Q		
1/4-20	7	7/16-20	25/64		
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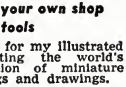

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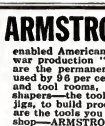

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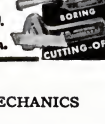

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Fill in coupon and mail today. Send no money. When your gorgeous Forest Fire Lamp arrives just deposit $4.95 plus postage through postman. Show it to your family and friends. Use it yourself in your home for ten days at our risk. Then if you aren't so delighted with your bargain that you won't want to give it up for all the world, return and get your money back. DON'T WAIT BUT WRITE TODAY!

Niagara Falls Lamp Also Available

Imagine a lamp that portrays Niagara Falls in all its scenic splendor. Will bring back those romantic memories of your honeymoon.

FREE FOR PROMPT ACTION

Amazing Wonder Leaf . . .

If you act now you will receive absolutely FREE as a reward for promptness, a marvelous WONDER LEAF, so startling, so beautiful that it causes comment wherever seen. Simply pin the WONDER LEAF to curtain, it lives on air alone . . . grows unique, amazing plants! Act now . . . offer may be withdrawn at any time because of limited supplies.

MAIL 10-DAY TRIAL COUPON NOW

SCENE-IN-ACTION LAMP COMPANY, Dept. F-1905
Grand Rapids, Michigan

Send order checked below. I will pay postman on arrival of lamp(s) on guarantee that I may use 10 full days and return if not satisfied and get full refund. (Send money with order—Scene-In-Action Lamp Co. will pay postage.)

☐ Forest Fire Lamp, $4.95 ☐ Niagara Falls Lamp, $4.95

NAME.....

ADDRESS.....

CITY.....ZONE....STATE.....

***why not use a* DIAMOND?**

ALL PURPOSE GRINDING WHEEL DRESSER
FOR ALL DRESSING OPERATIONS

$2.50 POST PAID

SEND CHECK OR MONEY ORDER TO

KOEBEL DIAMOND TOOL CO.
9454 GRINNEL AVE., DETROIT 13, MICH.

BUILD ARC WELDER PLANS 35¢

We Show You How to build this new powerful welder without rewinding. For light or heavy work. Uses coils taken from old auto generators. Works on 110 or 220 volts A. C. Has 20 different heats. Send 35c for complete PLANS and valuable Catalog. Write today.
LEJAY MFG. CO., 1347 LeJay Bldg., Minneapolis 8, Minn.

SAVE MONEY ON GASOLINE

FITS ALL CARS

Now you can get up to **30%** extra gasoline mileage with a Vacu-matic on your car. Quicker pick-up, smoother running, added power saves money every day. Guaranteed.

Automatic Supercharge Principle

Vacu-matic is *entirely different!* Operates on the Supercharge principle. Saves gas. Automatically provides a better gas mixture. Guaranteed to give up to **30%** extra gas mileage, more power and better performance.

SALESMEN WANTED

Big profits. Every Car a Prospect. Send name and address for FREE PARTICULARS and how you get yours for introducing

Vacu-matic Co., 7617-1282 W. State St., Wauwatosa 13, Wis.

6 handy tools in ONE!

1 MITERING GUIDE
2 DIAMETER GAGE
3 ACCURATE SQUARE
4 MARKING GAGE
5 CENTER FINDER
6 CONVENIENT RULER

$1.50 POSTPAID

Miter Master takes the place of an expensive miter box accurately set to any angle. Scale marked for mitering 5, 6, and 8-sided frames. Steel construction. Built to last a lifetime. If your dealer can't supply you we will send it postpaid anywhere in the U. S. for $1.50. (Foreign $1.75.) Unconditional guarantee. If not satisfied within ten days for any reason whatsoever, your money will be refunded.

MITER-MASTER

MASTER SPECIALTY COMPANY
3018 EAST LAKE ST. • MINNEAPOLIS 6, MINN.

YOU NEED THIS

FAST-ACTING AGENT TO relieve misery and kill cause* of

ATHLETE'S FOOT

Helps Guard Against Re-Infection!

Here's a product that *really* does what it claims. It's a Doctor's wonderfully soothing yet powerfully medicated liquid called Zemo. First applications relieve itching and burning between cracked, peeling toes and aid healing. Zemo actually kills on contact the vicious germs* that cause and spread this trouble. That's why Zemo has such an amazing record of *continuous* success. First trial convinces. All drugstores.

ZEMO

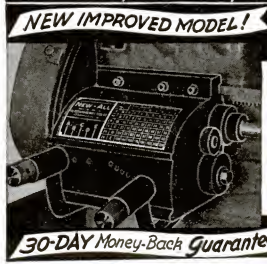
GERSTNER *Tool Chests*

Popular with Machinists and Toolmakers because of better construction and finer finish. Free catalog.

GERSTNER TOOL CHESTS
446 Columbia St., Dayton 7, Ohio

NEW-ALL QUICK CHANGE GEAR BOX
Increases Production up to 1000%

NEW IMPROVED MODEL!



PAYS FOR ITSELF in 30 DAYS!

30-DAY Money-Back Guarantee!

***Drastically Cuts* LABOR COSTS!**

NO TIME LOST FINDING GEARS! Inexperienced workmen easily produce top output. Easy to install. You simply drill and tap four holes.

Guaranteed Accuracy!

IS GUARANTEED TO CUT ACCURATE THREADS from 4 to 224 per inch with approximately 5/1000 feed for line turning. It safeguards entire production in process throughout the complete operation.

Precision Constructed

PRECISION CONSTRUCTED THROUGHOUT with gears of quality hobbed steel. Gear Box housing is made of high grade aluminum alloy casting—with replaceable bronze bearings.

NEW LOW PRICE . . . $75.00 F.O.B. Los Angeles
For ATLAS, CRAFTSMAN, LOGAN, POWERKRAFT and SOUTH BEND 9-in., 9 & 6—Use Your Own Lead Screw.
Write Div. PMG

WESTERN AIRCRAFT TOOL CO.
650 No. Hoover St. Los Angeles 4, Calif. NOrmandy 2-4711

forces succeeded in destroying 996 German, Italian and Japanese submarines before V-J day.

While not a primary weapon, as in the case of the antisub vessel, sonar also constituted an effective part of U. S. submarine equipment. In most cases when stalking an enemy surface craft a submarine relies on its hydrophones and periscope. Sonar sets up sound waves which may be detected by the enemy.

However, sonar was extremely helpful to submariners when approaching hostile shores, especially when invading enemy harbors while submerged. Low-power projectors and BDI warned of antisubmarine nets and other barriers and, conversely, indicated open channels for passage into inner harbors. Sonar also proved valuable in evasive tactics, enabling the submariner to ping back and jam surface craft sonar.

The battle of sonar goes on—in the laboratories. For the realm of supersonic sound remains largely unexplored. With peace, the scientists are seeking new ways to utilize these mysterious electrical impulses. Among them are such projects as the precipitation of smoke, homogenization of milk, fine emulsification—giving smoother ice cream or mayonnaise—acceleration of aging wines and spirits, the treatment of seeds to stimulate plant growth, the mixing of metals to produce alloys and the detection of imperfections in castings.

Already supersonic echo-ranging gear is being used successfully to detect fish at sea. On the Pacific coast, for instance, the sardine industry is locating schools of fish by sound waves. As an aid to navigation, the Submarine Signal Company of Boston has perfected an echo-sounding device that records instantly the exact depth of water beneath the keel of a ship.

Thus from the crucible of war has come another great technical advance—sonar—the amazing "ears of the sub killers."

Telling the World

(Continued from page 152)

wire to its Long Island short-wave transmitter, which handles 488 words a minute.

The UN operators transmit in eight or 10 foreign languages and pay little attention to what they are feeding to the teleprinters. In this respect they differ from the Western Union men who pride themselves on being connoisseurs of copy and take judicial notice of every paragraph they send.

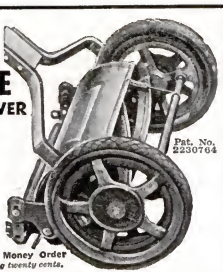
The only direct service to Denmark and Madagascar is provided by the American Cable and Radio Corporation, which com-

(Continued to page 252)

It's Safe, Quick, Simple, Efficient

NEW

KUT-RITE LAWN MOWER SHARPENER



Pat. No. 2230764

Grinding wheel principles applied. Actually self sharpening. Takes only 3 minutes—costs less than one professional sharpening, and equally as good.

14" $1.25 F.O.B.
16" $1.33 F.O.B.
18" $1.50 F.O.B.

Send Check or Money Order

Postage for mailing twenty cents.

ACCURATE SHARPENER MFG. CO.
2230-A N. Hubbard Street,
Dept. P.M. 7, Milwaukee 12, Wis.

BUSINESS OPPORTUNITY offered—small investment earn big money—Order yours today. Dealers and agents wanted.

VISE-GRIP WRENCH

Does More Things Easier, Quicker, Than Any Other Tool!

Remains locked to the work with hands removed. Holds anything, any shape, with a grip that never slips. Built with strength to back up its power. Made of fine alloy steel. Electroplated. Two sizes. 7" and 10".

Sold thru Tool Jobbers and Dealers

Invented, Developed and Made World Famous by
PETERSEN MFG. CO., DEPT. P-76, DeWitt, Nebr.

REPAIR CRACKED BLOCKS AND HEADS—

External and internal leaks in blocks, cylinders and valve ports quickly and easily with **LUSCO PLASTIC SEAL.** 90 day Service Guaranteed or your money back. Send money order or check for full pint—more than sufficient for average repair.. $3.00 Postpaid

C. F. LUSK CO., 4607 EUCLID AVE., CLEVELAND 3, OHIO

PLASTICS!

Fabricating plastics offers you a fascinating hobby or a profitable business.

New Carmen-Bronson Plastics Handbook tells you how; gives construction plans. New Carmen-Bronson Catalog lists all needed materials—Plexiglas, Lucite, Bakelite, Lignolite, Tenite II, Lumarith in sheets, rods, tubes, special shapes—clear and glowing colors. Also plastics dyes, cements, accessories and supplies. 10c brings you both catalog and handbook. Send for them today.

CARMEN-BRONSON COMPANY
165 EAST 3RD STREET, DEPT. 7-B, MOUNT VERNON, N. Y.

MAKE BIG MONEY!

Be a floor surfacing contractor and sand both new and old floors. Sanders are easy to operate and better still, you're your own boss. Write for latest "sell-all" booklet entitled "Opportunities in Floor Surfacing", enclosing 25 cents in coin or stamps to cover handling.

AMERICAN
FLOOR SURFACING MACHINE CO.
858 So. St. Clair Street • Toledo 3, Ohio

Anybody can be a candid camera expert almost overnight with the new

MERCURY II (its a UNIVERSAL)

ESPECIALLY DESIGNED FOR COLOR

MERCURY II will take the blush out of your family album. Now, *anyone* can take striking portraits or split-second action shots. Its amazing simplicity and foolproof features make this precision instrument perfect for both camera rookie and camera star. Check Mercury II before choosing a new camera.

UNIVERSAL CAMERA CORPORATION

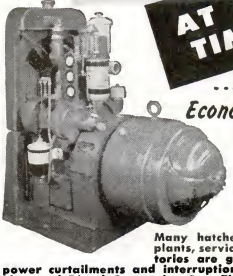
NEW YORK • CHICAGO • HOLLYWOOD

Manufacturers of Mercury, Cinémaster, Corsair Cameras and Photographic Equipment

ELECTRICITY

AT ALL TIMES

...and Economically, too!



Generating Sets
2,000 to 36,000 Watts

Many hatcheries, frozen food plants, service stations and factories are guarding against power curtailments and interruptions by installing a Sheppard Diesel Generating Set. They know a Sheppard on the job insures a steady supply of electricity *at all times*. That's why they all say "Diesel's the Power . . . Sheppard's the Diesel."

Power Units ● 3¾ to 56 H.P. **Marine Engines ● 3¾ to 62 H.P.**

R. H. SHEPPARD COMPANY, INC., 48 Middle St., Hanover, Pa.

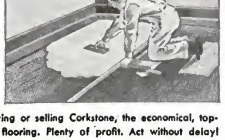
DIESEL'S THE POWER - *Sheppard's* THE DIESEL!

MAKE MORE MONEY

APPLYING OR SELLING

CORKSTONE PLASTIC FLOORING

EASY TO APPLY



Here's your opportunity to get into business for yourself applying or selling Corkstone, the economical, top-grade plastic flooring. Plenty of profit. Act without delay!

Dealers & Agents Wanted

WRITE FOR DETAILS OF OUR PROPOSITION

We believe in teamwork and cooperation. We'll help you get started. No cost; no obligation. Act today!

LASTING PRODUCTS COMPANY
MANUFACTURERS OF PAINTS, PUTTIES, PLASTICS
FRANKLINTOWN ROAD PLANT, BALTIMORE 23, MARYLAND

AN EXTRA HAND-

FOR PAINTING

Paint stays level - can't swing or spill. "Painter's Pal" clamps on pail, hangs securely on ladder. Fits quart to gal. pails. Stamped and welded steel construction. Holds 100 pounds. For right or left hand. Satisfaction guaranteed.

"Painter's Pal" For Brush and Pail At Your Dealer Or $1.25 prepaid, from

GENERAL ENGINEERING CORP.
CHARLOTTE MICHIGAN U. S. A.

All Steel TRUCK

Order Monday—Get Friday—$14.95 for 1...Lots of 3 $13.95. "Handee" nat. adv. Thousands in use. 5x2 rub. trd. whls. 600 lb. cap. 48" ht. 14" nose width. Easy handling. Wt. 28 lbs. For all purp. 1% 10 da. Return express collect if not 100% satis. FOB. Order from

HANDEES CO., Dept. 230B, Bloomington, Ill.

BUILD YOUR OWN FAN with that old motor

One piece cast aluminum propellers used for cooling and ventilating. Also available to dealers at discount.

Let us give you our prices on your aluminum castings

Size In	Polished 2 Bl.	Polished 3 Bl.	Unpolished 2 Bl.	Unpolished 3 Bl.	Bore In.
15	$2.50	$3.50	$2.00	$3.00	½, ⅝, ¾
18	3.00	4.00	2.50	3.50	½, ⅝, ¾
20	3.25	4.25	2.75	3.75	½, ⅝, ¾
24	3.50	5.00	3.00	4.25	½, ⅝, ¾
30	5.00		4.00		½, ⅝, ¾, 1

KLOPPENBORG ALUMINUM FOUNDRY, Dept. SM3, Davenport, Iowa

MARCOT KEY MACHINE

Marcot No. 8 Key Machine Mounted on Cabinet	$ 75.00
Book on Modern Locksmithing	3.95
Auto Code Book and Auto Depth Key	12.50
162 Ign. popular Key Blanks	77.76
Set Key Files, Tools, Pins, Springs, Thimble	10.50
	$179.71

A. J. MARCOTTE CO., 1200 N. Kedzie Ave. CHICAGO 51, ILL.

RADIO PARTS GRAB BAG!!

$25 original value assortment of Coils, Condensers, Transformers, Resistors, Controls, etc. An experimenter's dream. While they last. only..... **$3.98**

MARKO SUPPLY, Dept. P.M. 7
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LIKE WINGS ON YOUR CAR

This powerful inexpensive impeller supercharger can be yours — will fit any automobile—adds up to eight horsepower—has gas saving qualities—complete plans for easy building —send for free literature. AIRCHIEF SUPERCHARGER CO., P.O. Box 1102, Dept. 14, San Diego 12, Calif.

BLOWERS HEATING COOLING

Blowers and Cooling Supplies. Gas and Oil Burning Furnaces. Conversion Burners. Good Profits. Wanted — men to sell and install.

PEERLESS SALES, 4318 Sheridan, Lincoln 6, Nebr.

1 New - Improved OIL FOR ALL ---

HOUSEHOLD-SPORTSMAN-MECHANIC

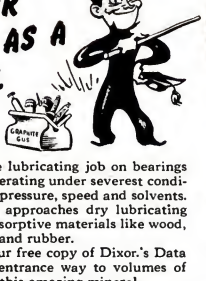
Lubricates - Prevents Rust - Cleans Metal

3 oz. 40c

FIENDOIL

GRAPHITE GUS ASKS:

KNOW YOUR GRAPHITE AS A FINE TOOL



Does a craftsman-like lubricating job on bearings and metal surfaces operating under severest conditions of temperature, pressure, speed and solvents.

Nothing else even approaches dry lubricating graphite for use on absorptive materials like wood, leather, fibre textiles and rubber.

Write today for your free copy of Dixon.'s Data Sheet Directory, an entrance way to volumes of use knowledge about this amazing mineral.

The complete line of Dixon's products into which graphite is processed is stocked by Mill, Hardware, Automotive, Marine, Sporting Goods, Plumber and Janitor Supply stores everywhere.

30¢

DIXON'S GRAPH-AIR GUN

Filled with Microfyne powdered graphite, it's the slickest gadget you ever saw for lubricating locks and hard-to-reach mechanisms, in shop, office, car, boat, home. Will not leak or gum. Described on Data Sheet #8.

15¢

DIXON'S GRAPHITE SLIPSTIK

For rub-on lubrication. Easy to use as a lip stick. Fine for fire arms, sticking doors and windows, bicycle chains—1001 mechanisms in shop, office, car, boat, home. Keep one near you. Described on Data Sheet #23.

20¢ 1 Oz. Tube

DIXON'S GRAPHITE LATHE-CENTER LUBRICANT

Used in thousands of plants for one of the toughest lube jobs known—lathe dead centers—under severest conditions of heat, pressure and speed. Use wherever "hot spot" lubrication is needed. Described on Data Sheet #15.

Joseph DIXON Crucible Company • Div. 26G7 • Jersey City 3, N. J.

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Learn this easy, money making business from nationally recognized consultant. Small investment; perpetual market. For free details write Joseph B. Kushner, B.S. Ch.E., Metal Finishing Consultant, Stroudsburg, Pennsylvania, R.D. 3J.

Get Into Plastics

Beautiful articles easy to make with the JACASO KITS and instructions. PLEXIGLAS. LUCITE. LUMARITH. We have in stock any plastic materials you need, including dyes, cements, buffing compounds.

Send card today for complete catalog H. Beginners experimental kit $2.00

JACASO COMPANY

Box 180 Lakewood, New Jersey

12 ASSORTED NEW HIGH SPEED ROTARY FILES ¼ Inch Shank SEND FOR CIRCULAR — ONLY $6.00 POSTAGE PREPAID

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ALUMINUM CIGARETTE LIGHTERS

Agents Wanted!

SENSATIONAL SELLER

Slim and trim, this lighter sells on sight. Attractively finished in non-tarnishing satin aluminum with streamlining accentuated in brilliant red. A sure-fire light every time. *Ceiling price $4.50 each, new low price to you only $9.40 per dozen.* Sample $1.00 prepaid. Sell through jewelry, drug, cigar, gift and novelty shops—also to friends. A most profitable side line. Literature free.

Your price $9.40 per doz. *Send trial order now!*

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Say you saw it in Popular Mechanics

YOU NEED THESE CRAFTSMAN'S TOOLS

SUPER DRILL GRINDER

Sharpens round shank drills from 3/32" to 1 1/16" diameter. Grinds Old Drills like new in 4 different drill point angles. Grinds Short, Medium and Long Twist Drills from 1¾" up to 11" long, for hand or power grinding wheels.

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Grinds your drills like factory in 25 seconds. Gives perfect center and clearance. Saves drills, time and money. No shop should be without the Super Drill Grinder. Guaranteed to do the work or money back. The Grinder that gives a round point!

Only $2.95

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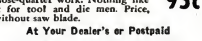
(PATENT PENDING)

A combination drilling or grinding wheel attachment. For ⅜" motor shafts. Will take grinding wheel with 1" hole on shaft and ⅜" hole on small end. Extension can be used for rag or wire wheel, or ⅜", 24-thread drill chuck which holds drills from No. 60 to ⅜" in diameter. Right hand thread only.

Price Only $1.50

SUPER HACKSAW

AND FLAT DIE FILE HOLDER



The tool with 100 uses! Holds broken hacksaw blades—used by mechanics, electricians, plumbers, auto mechanics, hobbyists and repairmen. Perfect for all-'round household needs; ideal for difficult close-quarter work. Nothing like it for tool and die men. Price, without saw blade.

Only 95¢

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Smooth, steady power at your fingertips! Perform precision operations not possible with any other portable tool! With a Handee you can turn out professional looking projects for pleasure or profit—ship, plane and train models, costume jewelry, wood carvings, puppets, initialed tumblers, etc. AC or DC. 25,000 r.p.m. Wt. 12 oz.

USE THE RIGHT ACCESSORIES! Choose them from the most—complete line . . . more than 300 made right in the Handee plant.

GET A GOOD START
GET THE
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HANDEE Tool and 45 most popular accessories packed in compact steel carrying case. You'll be amazed at what you can accomplish!

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Send ☐ Handee Kit ☐ Handee Tool ☐ Precision Attachments
☐ C.O.D. ☐ Remittance enclosed ☐ Send Manual

Name.....

Address.....

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prises two cable and one radiotelegraph service. All America Cables serves Latin and South America, Commercial Cables links the U. S. with Great Britain and Europe and Mackay Radio covers most of the civilized world.

ACR's teleprinters transmit 75 words a minute to its downtown office and from there it is forwarded by cable and radio. For radio transmission the Kleinschmidt tape is used—a paper strip which operates on the same principle as a player piano roll. The message is "written" on the strip by means of variously positioned punches and is "read" off onto the transmitter either by mechanical feelers which penetrate the punches or by an electric eye. The message comes off the receiving machine at the destination in wavy lines which are interpreted by the operator and transcribed on a typewriter or teleprinter.

Even more streamlined than the ultra-efficient telegraph and cable service is the setup arranged by the Associated Press, United Press, International News Service and the New York Post. These four have silent sounders—noiseless Morse code senders—right in the press galleries and their correspondents can whisper their flashes to the operators and have them in their local offices in a matter of seconds.

From 5000 to 6000 calls a day are handled by the New York Telephone Company in and out of the world capital. Equipment includes a 500-phone system with 100 trunks handled by 30 operators and four information clerks. The telephone people look for an ultimate installation of 1500 phones, but this doubtless will wait for the fall move to Lake Success, Long Island.

One company employee is sure he was made the victim of a global practical joke. An installation foreman, he returned from the armed services and selected his former Bronx territory as a quiet beat in which a man could gradually accustom himself to the rigors of civilian life. Two days later the UN moved in on him and he didn't get home before midnight for a month.

The contractors who refurbished the college gymnasium for the council meetings also met up with a telephonic joker. One of the first instruments was assigned to them and placed in a small, unoccupied room. One morning the builders arrived to find the room filled with furniture, locked and protected by a very determined armed guard. The guard was adamant and the contractor loath to attempt to complete such a rush assignment while incommunicado, so the phone company persuaded the guard to put his pistol down long enough

(Continued to page 256)

RADIO PHONES

Made to U. S. Army Specifications, passed by Signal Corps Inspectors. Dynamic Microphone and dynamic receiver of finest quality —Water, shock, weather and altitude proof, used on tank and aircraft (B19) intercom systems. For recording, for battery-less telephone, talk through your radio set or use earphones for pocket-size set loud speaker.

Complete two receiver, cord set, head band, and dynamic hand microphone including special connecting cord set. Less than regular cost of dynamic mic..... **$9.95** Postpaid

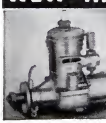
King of ELECTRIC SWITCHES

Versatile Switch of a Thousand Uses
Millions in Post War Applications

Floodlights your porch when the door is opened — sounds alarm when window is opened—signals arrival of mail—controls heating of furnace—filling of water tank, these and many other services are performed by this versatile switch. Shipped with instruction sheet showing numerous illustrated uses for this device at the low price of **$1.00** Postpaid

KING PRODUCTS COMPANY BATAVIA 2, ILLINOIS

NEW THOR "B" ENGINE-$9.95



The new THOR "B"—Sensational miniature gasoline engine that really works. Super-power performance featuring new presto starting device, larger crank shaft, better fuel control, improved Cam and Timer, Wear-Proof rod. Smooth, velveted power that roars into action with a "twist of the wrist." Over 10,000 already sold. 1/6 H.P. Complete with coil, condenser, and fully illustrated instructions, only $9.95. Bench tested, ready to run, guaranteed. Powers all models. Send $1.00 — shipped collect same day C.O.D.

FREE Just off the Press. Send for big 40-page illustrated hobby catalog with over 300 illustrations; over 1,000 listed items. The "Bible" of wideawake modelers. Write for it now—no obligation, naturally!

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WELD ANYTHING ANYWHERE ANYTIME

ALL PURPOSE ARC WELDER

9 Models . . . 32 Volt D.C., 110 to 440 A.C.

A complete workshop in itself! Weld, cut, braze or solder any type metal; iron, castings, aluminum, steel, bronze . . . in any gauge or weight, with equal ease. Compact, complete, sturdy as the Rockies. Formed steel and cast aluminum case, welded steel base, 4" cast wheels. Built with voltage control. Better on R.R.A. lines. No training needed. Sold throughout the world. **Unconditionally guaranteed for 2 years. Fully equipped—ready to use.**

FORNEY MFG. CO.
FORT COLLINS 2, COLORADO

EXPERIMENT WITH BLACK LIGHT!

FUN! THRILLS! PROFITS! See seven page article on this fascinating science in June 1945 issue of Popular Mechanics. We furnish all supplies. Trial Kit of 8 lacquers only $6.25. Black bulb for testing, $2.00. Lamps, lacquers, crayons, fabrics, etc. Write for descriptive list and full details today!

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BICYCLE LIGHT GENERATOR

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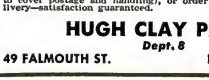

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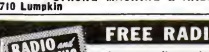

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for them to retrieve the telephone and install it elsewhere.

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The International Division of NBC broadcasts news of the council in English, Spanish, Portuguese, German, French, Italian, Danish and Swedish, using 22 to 24 transmitters a day. Almost every day UN news is included in these daily broadcasts beamed to Latin and South America, Europe and Africa.

The Columbia Broadcasting System's international network operates on a daily seven-hour schedule in English, French, Italian, German, Dutch, Polish, Czech, Serbo-Croatian, Spanish and Portuguese. Its 112-station Latin American network is giving listeners south of the border thorough coverage of the meeting.

The most comprehensive international radio coverage ever achieved is claimed by the International Broadcasting Division of the State Department, which has a schedule of 64 broadcast hours a day in 18 languages—including Tagalog and Bulgarian. This service adheres strictly to straight factual reporting.

The British Broadcasting Company, Canadian Broadcasting Company and Radio Belgium serve their national audiences, the volume depending on the importance of the day-to-day news.

For the 80-odd million weekly moviegoers five newsreels cover the meetings in a pool arrangement. Fox Movietone, MGM News of the Day, Paramount News, Pathe News and Universal Newsreel take turns in occupying the camera booth almost directly opposite the center of the Council table and all footage is made available to all services. This is for the sound coverage; the silent footage is shot almost entirely by Universal.

NBC television not only brings sight and sound of the council into the homes of owners of video receivers but has proved a valuable adjunct to press coverage as well. Since only a third of the correspondents accredited to the UN can be accommodated in the press galleries and other reserved space at one time, this meant that approximately 500 newsmen and women were out in the cold.

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(Continued to page 260)

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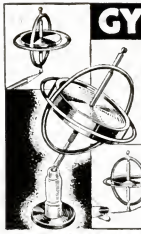

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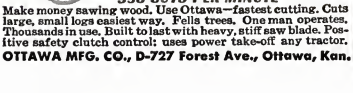

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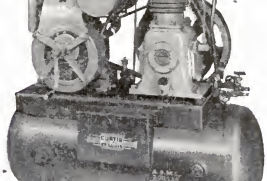

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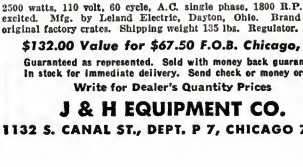

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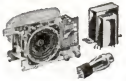

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comfort than the press galleries afforded.

This report would be incomplete without a mention of the one man who is literally indispensable to the entire communications setup. He is Major G. Robert Vincent, on leave from the Signal Corps for this vital assignment, who directed the installation of all the sound equipment and who sits in the control room, monitoring every word that is spoken in the meetings.

Seventeen microphones at the council table and four on the interpreters' table lead into his control panel and thence to the wide world. The public address system, radio, television, newsreels and recording devices—all are dependent on Major Vincent.

They could hardly be in better hands. Vincent, who has been working with sound for 34 of his 46 years, installed the equipment for the San Francisco Conference in two days and devised the amazing system for the Nuremberg trials by which a spectator may follow the proceedings in any one of four languages. Compared to that little job the Major considers the Security Council meeting a pushover—from the sound standpoint, anyway.

"Prep School" for Rocket Warfare

(Continued from page 87)

These include the angular rates around each of the three axes of the missile, position of each of the four control rudders, hinge movement on one control surface and longitudinal and transverse acceleration.

Small instruments in the rocket are actuated by these conditions and each of these mechanical quantities is made the frequency-controlling element of an audio-frequency oscillator. Five of the oscillators modulate a radio-frequency carrier wave of about 100 megacycles. The 10-channel instrument system consists of two five-channel groups, with the two transmitters using a common antenna that projects from the nose. The various frequencies are screened by filters on the ground and are separately transcribed on mechanical recorders.

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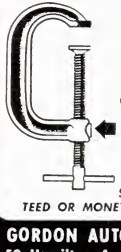

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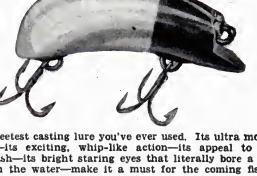

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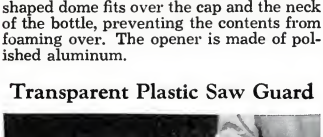

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$1.95

This MAGIC LIQUID Simplifies Photography. Simply take one drop of FOTO COLOR fluid, spread thinly on surface, place your negative over top and expose to light. Presto! you're finished. Anyone can become an expert. (*Complete directions included*)

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Let the youngsters in or out of doors without leaving your work. ELECTRELEASE opens garage, cellar or other doors without going out or downstairs.

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Amateurs or professionals . . . hobbyists or jewelers . . . Polish your own gems with a B&I Gem Maker. You will find this a profitable adventure. All necessary lapidary equipment is furnished, including a super-charged diamond blade for sawing, and all wheels for grinding, shaping and polishing, also complete instructions. The complete equipment as shown, less motor and belt, for only $29.50, f.o.b., Burlington, Wis. Write today for information and literature on the Gem Maker and accessories.

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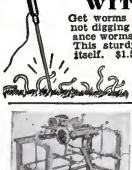

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Also Mfg., Saw Sharpening & Key Machines

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Mieto-Liner Service Corp
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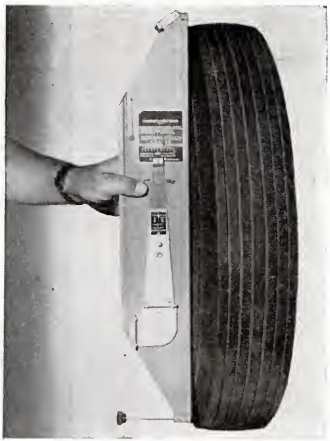
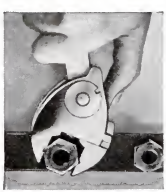
Gauge for Alignment of Wheels Tests Car in Two Minutes



Tests to determine camber or caster of automobile wheels are performed with a gauge that first checks whether there is any slope in the floor. Once the floor slope is measured, the gauge is set to make the proper compensations on all readings. It takes only 30 seconds to check the floor slope and camber of one wheel.

Trigger Adjustment on Wrench Holds Jaws Tight on Nuts

Instant thumb-trigger adjustment in an automatic ratchet-action wrench keeps the jaws in constant grip on square, hexagonal, metric and odd-sized nuts while the handle is in manual operation. The positive grip of the tool prevents rounding nut edges, reduces the danger of skinned knuckles and eliminates the necessity for frequent use of various sizes of end wrenches.



¶A method has been patented for using sodium silicate, or "water glass," as a flexible insulation for electric wires by applying it in solution and then heating.

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Come back with perfectly exposed pictures every time. It's easy with the new, improved G-E exposure meter to guide your camera. Gives you correct exposure in a jiffy. New, simplified dials make it easier, faster to use. Proved accuracy. Extreme sensitivity. And *now* lighter, sturdier. The ideal travel companion for your camera. A grand gift. See the G-E meter at photo dealers . . . it's 3 meters in one. *General Electric, Schenectady 5, New York.*

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- Fine, perfected card felt playing surface.
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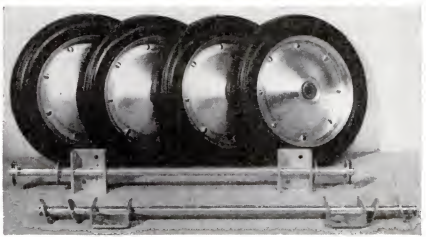

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A Model 2 Moto-Tool develops a speed of approximately 27,000 rpm. Weighs only 13 oz. Shaped to fit the hand. Sturdily built. Has shock-proof bakelite housing. Balanced for vibrationless operation. Uses 110-120 A.C. or D.C. current. Patented automatic chuck lock pin makes removal of accessories easy. Pin disengages automatically . . . prevents accidental burning out of motor.

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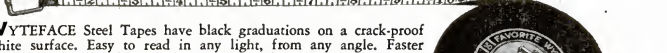

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SOMETHING NEW. For Electricians, jewelers, dentists, garages, field service repair men, plumbers, farmers, refrigerator, and all types of brazing and fixit-shops.

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KIT INCLUDES:
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For very fine to heavy Brazing & Silver Soldering, complete with carrying case $6.50. Type MC gas tanks, 30 cu. ft. $5.50. Type B, 40 cu. ft. $12.50. Prices F.O.B. shipping point. Cash with order.

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DESIGNED TO DO HIGH GRADE WELDING INEXPENSIVELY—Maintenance Men; Farmers; Mechanics; Machine Shops; Foundries; Auto, General Repair and Job Welding Shops; all using the DYNAMIC find it so indispensable and useful that they cannot afford to be without it. If inexperienced, you can easily learn to do a variety of high grade welding jobs by following the practical, simplified operating and welding instructions furnished. Once you see a DYNAMIC in operation, you won't want to be without it. Its simplicity will amaze you. In a year the DYNAMIC only costs you about 6c a day. Helmet, rods, cables, holder and operating instructions, etc., furnished.

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This portable DYNAMIC WELDER — easily carried to the job — can be operated from any convenient, properly wired 110 volt, 60 cycle line. Can also be supplied for 220 volt, 60 cycle operation and for other voltages and cycles at slight additional cost. Works on IRON, STEEL, BRASS, BRONZE, AND OTHER METALS—has 8 metallic and carbon arc welding heat stages—does work you would think only possible with larger more expensive machine.

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BOMB PARACHUTES

Of fine white nylon fabric 5 x 8 feet in diameter with split seam for directional dropping. Designed for dropping fragmentation bombs, emergency rations, etc. Each packed in a metal container. Weight 13 lbs.
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Two handy, transparent plastic flasks with canvas case. Used by the U. S. Air Corps. Holds any kind of liquid. Each flask measures 4¼ x 3¼ inches. Has clamp-on top plus screw cap. Fine for use on camping trips, picnics, etc. Weight 1 lb.
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For all outdoorsmen, boy scouts, etc. Liquid type, free acting and accurate. Gives direct reading. Tells you immediately what direction you are traveling. Plastic body measures 3¼ x 1¼ inches. Has waterproof compartment for matches.
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Consists of trigger and trip arrangement with cord for remote firing control. Has powerful spring action. Ejects a pencil 8 to 10 feet. Has many uses such as burglar alarms, etc. Brand new!
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Brand new shoulder type duffle bag pouches, ideal for luggage, school books, lunches, etc. Measures 11 x 12 inches. Of heavy canvas duck with taped edges. Weight 2 lbs.
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For your car, boat, furniture, etc. Highly polished chrome finished strips with clinched edges for flush mounting to any surface. The 3 round kit provides approx. 43 pieces in lengths from 4 inches to 3 feet and ¼ to ¾ inches wide. Wgt. 4 lbs.
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MESS KITS

Regulation Army Mess Kits. Ideal for campers, boy scouts, etc. Slightly used but guaranteed perfect. Two pieces. Folding handle.
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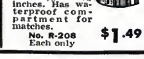
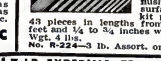
G I BELTS



Of heavy canvas webbing. Adjustable lim size. Snap-on buckle. Eyelets all around. Used, but guaranteed.
A131—EACH **98c**

7-LB. EXPERIMENTER PARTS ASSORT.



A "gold mine" for the radio serviceman. Hundreds of valuable radio parts, new radar and electronic parts and subassemblies, coils, resistors, trimming condensers, —worth many times this low price.
A130R—7 LBS. **$1.79**

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Regular U. S. Gov't issue canteens. Plastic screw top cap chained to body. Slightly used.
A117—METAL BODY. Each.. **69c**
A118—PLASTIC BODY. Each..... **69c**
A109—Canteen Covers. New. Each..... **35c**
A119—Canteen Covers. Used. Each..... **35c**
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Brand new! For experiments in radio, electronics and other experimental apparatus. Used in telephone, amplifier and detectaphone work. Diameter 1¼ inches. New.
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Fine for storing valuables, carrying lunches, etc. Of heavy gauge 7½ x 1x4 inches. Fiberoid. Hinged lid with folding handle. Olive drab finish. Used, but perfect. Shipping wt. 4 lbs.
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Turn control unit assembly from an aeroplane, consisting of a valuable assortment of gears, switches, mechanical and electrical parts. Fine for experimenters, inventors, etc. Illus. shows unit with cover removed. Shp. Wght. 10 lbs.
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U.S. Govt. BOLO KNIFE

Extra heavy. For farm, home or jungle use. Blade of Gov't. formula cutlery steel. Walnut riveted handle, 3½ inch butt. 10½ inch blade. You'll find hundreds of uses for a Bolo knife. Blade will take and hold a keen cutting edge. Wt., 2 lbs.
A112—with Army Sheath..... **$4.95**
A212—Leather Sheath, extra **$1.50**

PUP TENTS

Regulation Army Pup Tents of durable, heavy canvas. Used, but in good condition. Fine for campers, outdoorsmen, boy scouts, etc. Ideal for Xmas gift for children. Wgt. 5 lbs.
A100— Tent Only **$3.95**
A110—Tent, complete set..**$7.95**
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BIG SHIPS BELLS

Purchased from U. S. Maritime Comm. Measures 10 inches high, 9¾ inch flare. Big 6 inch clapper. Weight 15 lbs. Fine for farms, clubs, estates, etc. All new. Ship. wt. 10 lbs.
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Consists of alcohol burner and sterilizing tray in hinged metal case 1¾ x 2¾ x 2¾ inches. Burner may be used separately. Brilliant nickel finish. All brand new.
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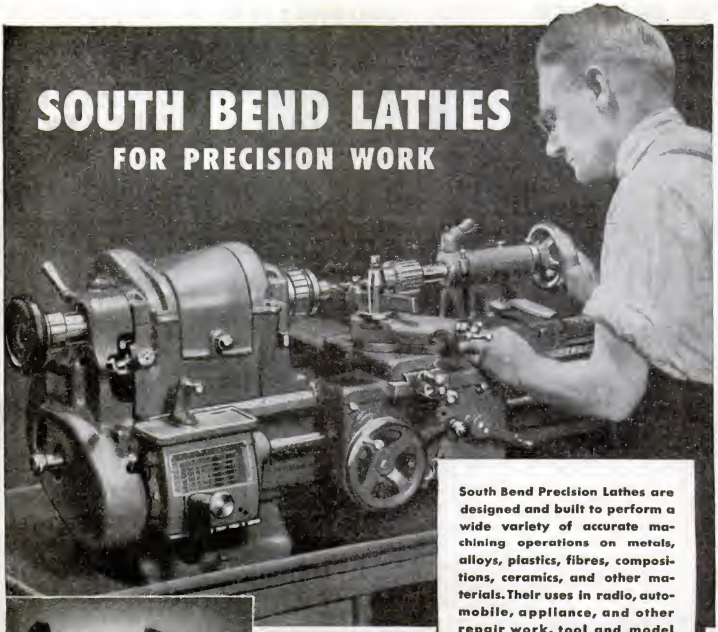

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